MECHANICS' MAGAZINE,

AND

REGISTER OF INVENTIONS AND IMPROVEMENTS.

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TO THE PATRONS OF THE MECHANICS' MAGAZINE.—With this number, I close the *third* year, or 6th volume, of the work.

In thus bringing to a close, in that department devoted to my mechanical friends, the labors of another year, it will not, I trust, be deemed improper for me to refer to the past, by way of apology for the numerous deficiencies, with which, as the conductor of the Magazine, I may be justly charged; and at the same time to speak of my intentions, in relation to its course; and of my hopes and expectations for the future.

When I first proposed to publish this Magazine, now three years since, I was induced to believe, from the *absence* of such a work, and the frequent inquiries for one, that if undertaken with spirit, and carried on judiciously, by any person who would call to his aid those who were competent to profit by the numerous and ingenious inventions, improvements, and suggestions of the day, and to select from the mass of useful materials, accumulated and accumulating, in this country, which ought to, and would be, (but for the want of a cheap and popular periodical, through the columns of which it might be disseminated far and wide,) in the hands of every artizan, mechanic and laboring man in the country—that, notwithstanding the heavy expense of publication, it would eventually become, not only a very useful, but also a profitable periodical. With this view of the subject, I embarked in the work, and commenced its publication, without a single subscriber; and, notwithstanding my numerous other engagements, by very great exertion I have continued it to the close of the *third year*—a period, during which, if at all, it would seem that a correct opinion should be formed as to its *utility*, as well as to the prospect of its meeting with sufficient patronage to warrant its continuance.

As to the *first*, its readers are probably better qualified, than its publisher and proprietor, to judge; and to them, therefore, I leave *that* question for decision; and I trust that they will answer in the affirmative, when I assure them that it will be continued, *although it has not thus far paid its expenses*, as it has been a separate and distinct work, devoted with fidelity and increased zeal to those whose title it bears.

It is true, that heretofore I have not been able, from the nature of *previous* engagements, to devote as much time to its columns as I desired, or as I ought to have done; but from this time I am relieved from the most arduous, and laborious part of my duties, the care of the *business* department of a *daily and semi-weekly newspaper*; and I shall, therefore, be able to give the Magazine more of my personal attention, and from its increased circulation, to furnish more valuable matter for its columns, and thereby to render it more interesting, and useful to its readers.

As an evidence of this determination, I now promise to republish, in the course of the ensuing year, NICHOLSON'S Treatise on ARCHITECTURE, which, of itself, costs $3, or as much as a year's subscription to the Magazine, and which will be found "*a complete development of the methods of drawing and working the five orders*, which may be said to be the foundation of the art of building." There are in this treatise, *forty-one* octavo sized plates, accompanied by concise, yet clear and explict, rules and directions for the following, among *many other* kinds of work, viz. to describe the several kinds of mouldings; to diminish the shafts of columns; to draw the flutes of do.; to draw the flutes and fillets on the shaft of a column, or pilaster; to glue up the shaft of a column; to draw the Tuscan,

or any other order; exhibiting representations of columns of the different orders, as taken from ancient temples of Greece and Rome.

In order, however, to give a better idea of the value of this Treatise, the preface is copied entire—and the fact that it has gone through *six editions* in England, and now sells, in this city, for *three* dollars a copy, containing less than 100 pages—it will be inferred, that it is likely to be of some utility, to, at least, a portion of the readers of this Magazine. In addition to this, will be given plain and explicit directions for building, from the Encyclopedia Britanica. I shall, also, endeavor to give a short treatise, or catechism, on *Phrenology*, with a plate.

The Students Instructor in Drawing and Working the Five Orders of Architecture.

Preface.—The following Treatise will be found particularly useful to Students in Architecture. It contains a complete development of the methods of drawing and working the five orders, which may be said to be the foundation, the very A B C of the art of building: as from these, with their several proportions and variations, arises all that is great, elegant, or harmonious in the noblest structure; wherefore I most earnestly recommend to the student, to obtain a thorough knowledge of every order, its parts, proportions, and entire figure, as being absolutely necessary to all who aspire to eminence in this profession.

To this purpose the following work is well adapted, and gives in the most detailed and accurate manner, examples of the five orders, their proportions and enrichments, according to the present taste; which are so completely explained by the lines, and the measurement on the plates, that a little attention will enable every person readily to comprehend the proportion, use, and situation of each member: and also the several methods adopted in calculating the parts, and for setting them off on rods for practice, to any scale.—The manner of drawing them on paper is fully explained, and I must here advise the student to make a diligent practice of drawing the outlines to a large scale, so hat the measures may apply with accuracy, before he proceeds to finish in shading; by so doing, he will acquire a facility of manner, and an accuracy of eye in judging of the beauties of proportion, which will ever be of essential use to him.

The explanation of the Tuscan order is given very full, and as the same methods apply to each of the other orders, they are not repeated. It is scarcely necessary to observe, the height of the several columns is given according to the most esteemed masters; nevertheless they may with much propriety be varied, to suit particular purposes or situations.

The method of describing quirked mouldings is new and easy, for practice, for any swell. I have shown a new method for striking the Ionic volute, which will produce that spiral curve with more elegance and regularity in the sweep, than by any other method I have seen.

That important branch of practice, glueing up of colums and capitals, is shewn in a new and accurate manner, easy to be understood. I have also shown new and easy methods for diminishing of columns, and for marking the flutes and fillets on them and on pilasters; which, with various other interesting matters, will, I hope, make the operative parts of the orders better understood, both in theory and in practice, than by any former publication.

P. N.

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Preface to the Third Edition.—The usefulness of this little volume has been fully proved by the great numbers which have been sold: a new Edition being now called for, I have examined the work throughout, and have made such corrections and additions, as appeared to be necessary to adapt it to the prevailing style of architecture: to this purpose I have given a new plate containing a variety of *Modern Mouldings*, also six new ones of *Antique Doric Capitals* and entablatures, with the parts at large and in detail: so that in this small work every member of these specimens of ancient magnificence is equally clear and distinct, as in the large work of the original author; and as I have reduced the proportions to the modular scale, they are more easily put in practice. Upon the whole, it will be found that the Greek Doric which has of late been so much in vogue, is fully explained and elucidated.

I have also given an example of a chaste and noble Ionic Capital; all these are selected from *Stuart's elegant and interesting work on the Antiquities of Athens;* the other new plates are an outline of the Composite Capital for the use of learners, and an antique Ionic Door-case, proper to be drawn from or worked. These additions, on ten new plates, with various corrections in the descriptions, render this edition more complete and useful; and I think there is now nothing wanting to constitute it a complete introduction to the orders of architecture both ancient and modern.

AMERICAN CEMENT, CR ARTIFICIAL STONE, or, as it it is more generally at this time known, "PARKER'S CEMBNT," is an article of great and increasing value to this community.

We recollect being at Syracuse in the summer of 1834, on a visit, where we were introduced to Mr. OBADIAH PARKER, as an ingenious and intelligent gentleman, who had made some valuable discoveries in the use and application of what is commonly known in that vicinity as *Water Lime;* and on visiting Mr. Parker's residence, in the immediate vicinity of Syracuse, we were shown some beautiful specimens of cisterns for rain water; steps for front doors to dwellings, and for various other purposes, which certainly gave strong evidence of great utility. We were then informed by Mr. P. that he intended to visit this city, with a view of introducing the article as a substitute for the common brick and mortar cistern, and on our return, late in the fall, were informed that he had done so; and that the American Institute had awarded him a *gold medal*, by way of expressing their high approbation of the value of his discovery, or new application.

Upon this, Mr. Parker commenced putting down cisterns in different parts of the city, with a view of showing, by actual test, subject to the frosts of the then coming winter, its value, and superiority, over every other material then in in use for such purposes.

From a numerous list of names and certificates, which we have seen, from gentlemen who were induced to give it a trial, we select the following as sufficient, though we might, if it were necessary, as easily give *hundreds* of others, to establish the fact, that the introduction of this article into general use will prove of almost incalculable benefit and convenience to this community—and that Mr. Parker is truly, and will be ere long justly, acknowledged as a public benefactor.

We merely give, in this place, the names of six gentlemen of this city, who put down cisterns last fall, together with a few others at Catskill, Greene county; and at Syracuse, Onondaga county, New-York; who have either had work done for their own use, or have witnessed that done for others, previous to the opening of the spring of 1835.

By these letters, it will be perceived, that similar results and opinions have followed its use in different and remote parts of the State.

The first is from gentlemen residents of Syracuse, and neighbors of Mr. Parker, who were familiar with his operations; the next from gentlemen residents of the same place, who had tested the utility of those operations; the third is from gentlemen residents of Greene county, who had examined specimens of the work; and the fourth are gentlemen residents of the city of New-York, who are, or may be known, to any one who desires further information.

The following testimony is given by gentlemen of this city, and the works to which they allude were visited by hundreds, who desired to test its utilty.

Syracuse Aug. 26, 1835.

We, the undersigned, inhabitants of Syracuse, having examined Mr. Parker's Water Cisterns, are fully satisfied of their usefulness and permanency, and confidently believe that they will be preferred and used by all who become acquainted with them.

Schuyler Strong,	S. Tousley,
M. D. Burnet,	S. W. Cadwell,
Rich'd. S. Corning,	Hiram Judson,
P. Thurber,	M. Williams,
Z. T. Newcomb,	Hiram Putnam,
Z. W. Cogswell,	John White,
J. H. Colvin,	E. F. Wallace,
L. H. Redfield,	M. S. Marsh,
J. C. Woodruff,	Joel Owen,

W. B. Goodfellow, C. L. Lynds,
Silas Ames, E. Walter,
Rich'd. R. Davis, S. S. Forman,
M. M. White, Amos P. Granger.
Henry Davis, Jr.,

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Syracuse, Aug. 26, 1834.

From having my attention frequently called to the new plan of erecting Cement Cisterns, as patented by Mr. Parker, and from a conviction of their decided superiority over any other in use, I was induced (as agent of the Syracuse Company) to employ him to construct one of the largest class, (containing sixty hogsheads) for the Syracuse House, and my expectations have been fully realized. These Cisterns combine, in an eminent degree, great durability, with cheapness of construction, while they preserve the water pure, and are much more easily cleansed than any other now in use.

H. Baldwin.

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I hereby certify, that the Water Cistern, erected by Mr. Parker, for the benefit of this house, containing 200 barrels, proves to be a first rate article, and I recommend his mode as superior to any other.

Daniel Comstock.

Syracuse House, 26 Aug. 1834.

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Catskill, 12 Feb., 1835.

We, the undersigned, residents of the county of Greene, now in attendance at Court, have, by invitation, visited Mr. O. Parker's establishment in this village, and examined his specimens of Artificial Stone, ranging in age from six months down to four days, and are perfectly satisfied that his Cement is an invaluable article, for all kinds of architecture. Mr. Parker has shown us a Tan Vat, of perfect form, and the end wall of a house ten inches thick, sixteen and a half feet long, and eight feet eight inches high, with a door and two windows, standing firm. This wall has a hard finish, on both sides. From this specimen, we are satisfied, that Mr. Parker can give his walls as smooth a surface as can be made on any wall whatever. He has, also, shown us other specimens of great utility. By his inventions, Mr. Parker is giving to the community one of the most valuable discoveries of the age, and we most cheerfully recommend him to the consideration of all. We omitted to notice a few specimens of marble, made from cement, which are very handsome and smooth.

P. King,
Wm. Polley,
Henry G. D. Kirshaw, } Judges of the Com. Pleas.
John Lawrence, Sheriff.
Sidney Tuttle, Ex-Sheriff,
W. V. B. Heerlance, Clerk of Greene co.
Orrin Day, President Tanner's Bank,
Henry McKinstry,
Isaac Van Loan,
Rev. David Porter, D. D.,
Rev. Tho. M. Smith,
Rev. J. N. Wyckoff, V. D. M.,
Thos. O. H. Croswel, M. D.,
Abraham Van Vechten,
H. Hill, Jr., C. Hull, Jr.,
Ira Dubois, Wm. Van Bergen,
Elcila Blackman, Alonzo Green,
James L. Elliott.

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I had four Cisterns constructed last fall, of cement alone, according to Mr. Parker's patent, neither of which were in the least degree injured or affected by frost, the past severe winter; and I consider them superior to Cisterns of any other kind, being apparently as good, as if cut out of solid rock. I have also examined various other articles of Mr. Parker's work, and consider his inventions, in the use of cement, of vast importance to the public.

Sam'l. Whittemore.

New-York, May 18, 1835.

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Having had several pieces of work done in hydraulic cement, according to Mr. Parker's patent, and having seen Cisterns, and other articles composed of the same material, all which I regard as perfect, being far superior to the same kind of work done in brick or stone, laid in mortar, I cheerfully recommend them to the public.

Garrit Gilbert.

New-York, May 16, 1835.

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Mr. Obadiah Parker, in the fall of 1834, built four Cisterns, at our houses in Christopher-street, entirely of American cement; that they were exposed to the cold of the winter, which had no perceptible effect upon them whatever, and we consider them to have been tested as to strength, and believe they are much

better calculated to resist frost than brick or stone Cisterns, being entirely composed of one material; and that their capacity to hold water, we consider as beyond doubt. We have seen various models of improvements in the construction of the arch and curb, at No. 107 Amos-street, and from the experience we have had in the article, we should not hesitate to recommend them.

CLINTON GILBERT,
HENRY STOKES.

New-York, May 8th, 1835.

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I have had two Cisterns, built by Mr. O. Parker, composed, according to his patent, of hydraulic cement, and give them a decided preference over brick, stone, or any other material heretofore used, and recommend his invention to the public as a valuable discovery for all hydraulic purposes.

GEORGE BOWMAN, Master Mason.

New-York, May 1, 1835.

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I have examined the hydraulic cement works of Mr. O. Parker, and coincide with the above.

JOHN BOWMAN, Master Mason.

May 1, 1835.

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Thus far only had Mr. Parker proceeded at the opening of the spring; yet far enough, as it would seem, to satisfy many gentlemen that he had opened a field of ample dimensions, and one which promised richly to reward those who would diligently cultivate it. A company was formed, and suitable accommodations provided in Amos street, where specimens of various kinds might be prepared for exhibition; and where experiments might be carried on for the purpose of ascertaining and determining the various purposes to which it might be usefully applied—and that they might be at the same time prepared to execute such orders as might be given for cisterns and other purposes. They commenced by putting down several cisterns, vats, cellar-steps, specimens of aqueducts and sewers—and also by erecting a pillar, cisterns and vats above ground, together with numerous other specimens of curbs, arches and necks of cisterns, &c. &c. &c.—which soon attracted attention, and gave the Company more orders than they could execute.

In order to satisfy the community still farther, if it were necessary to do so, they commenced and completed an office for their own use, on the front of their lot in Amos-street—which is a beautiful specimen

of work. It is a small building about 16 by 12 feet on the ground and 12 feet high, having four beautiful columns and pediment, with a door and two windows in front, an *arched roof* entirely of cement, and sky light in the top—thus forming an entire building, including *floor*, *walls*, and *roof*, of one solid piece, and of *imperishable* material; alike proof against fire and water. The only wood to be seen in the structure is in the door, windows and casings of them. We give herewith a view of the building—the original of which may be seen at any time, by any person who will call at 107 Amos-street, in this city—together—if they will take the trouble to inquire for the Superintendant—with numerous and beautiful specimens of other kinds of work in the yard, immediately back of the office.

There is indeed something singular in this material—and in its rapid transition from a *paste, to a solid rock.* It may, when properly prepared, be poured from a vessel, a pail, for instance, into a mould, as you would pour thin porridge; and it will in a few hours become set, or hard, so that the mould may be taken from it, and the article moved from place to place, without injury—yet it may be cut with a knife as readily as cheese, for a short time, although it becomes harder and harder until it is

equal to freestone, *marble*, GRANITE, and finally until fire may be struck from it with a steel as from a flint, whilst it rings sharp and clear on being struck, like porphyry.

It is also capable of resisting intense heat, an important quality which is not possessed by some of our most valuable and fashionable kinds of stone, now much in use in this country; and it must therefore be extensively introduced for various purposes of building. It is also valuable for side-walks, for which use it is found to answer a good purpose; also for drains and sewers—for the latter of which purposes a beautiful specimen of about 2½ feet diameter has been laid down in Vesey-street, from the *Astor Hotel to the North River*, for the purpose of carrying off the wash of that immense establishment—and if it had been necessary, it might doubtless have been made *six feet*, as well as 30 inches in diameter, with perfect safety. Indeed, we see no good reason why an *aqueduct* might not be made of this material, *under ground*, for the purpose of introducing water into this city; and in order always to be sure of a constant supply, there might be *two* of them side by side, of *four* to *six* feet internal diameter, each with a thickness of material of 1½ to 3 feet, as might be deemed necessary—following the surface of the ground—or they might be constructed upon *long levels*, open at the top, and closed only where vallies, or considerable inequalities of the surface are to be passed—thus avoiding the enormous expense of constructing elevated aqueducts, which must otherwise be resorted to; thereby dividing the upper part of the city into two parts, admitting of passages under its arches only.

These, however, are only a few of the numerous uses to which it may be, or in fact, is already appropriated Beautiful specimens of *busts* or statuary have been already made—and it will also come into extensive use for coffins and cemeteries. We have seen specimens of coffins which received a beautiful polish, or any kind of stain, or painting, gilding that may be desired, with a glass over the face.

A coffin made of this material will be of about the same weight of one of similar size made of solid white oak. It will however have this advantage over one made of wood—the lid being put on with cement, after extracting the air with an air pump, it will not only be air tight, but will grow harder and more solid as time rolls on, preserving its tenant, though not in life, yet in form, as perfect, it is believed, for centuries, as when it was encased in its house of stone.

Time and space fails us to enumerate further the uses of, and benefits to be derived from, this valuable material; a material discovered and known to exist in this country only since the commencement of that vast and noble work, the Erie Canal. We shall, however, often refer to it again as its uses shall become more and more developed.

[For the Mechanics' Magazine.]

SILK AND WORSTED.

From the middle of the last century to the present time, may justly be reckoned as the commencement and progress of a new era, in almost the entire catalogue of the useful arts; or it may even be set down as an incontrovertible truth, that most of those arts date their very birth and existence, within that time. All that existed in practice, or was known of them, before that period, was as mere germs or embryos, from which they have sprung, and are daily springing into real life. Before that time, the arts were conducted on no fixed principles. Every mechanical operation was performed by the joint effect of imitation and habit, as a parrot learns to speak, or a monkey to perform gesticulations. *Science* was to art a mere laughing-stock, and *art* was looked upon by *science* as a subject of contempt—utterly unworthy of respectful notice.

But about seventy years ago,

"A change came o'er the spirit of the dream."

About that time, the *soi disant* chemists, whose science had hitherto consisted of whim-wams and opinions, with some isolated facts, which, though important, bore no known analogy with each other, began to discover, in different parts of the world, that these supposed disconnected facts, were the connected links of a chain or

body of science, of infinite importance to the world; and that the workshop of the mechanic, and the field of the agriculturist, were but exemplifications of scientific principles, which, if applied to useful practice, would produce results which ambition had never dreampt of. A Schule, a Priestly, and others, began to suspect that these fragments bore relationship to each other, and a Lavoisure succeeded in putting the puzzle together.

Philosophers, in various quarters, began now to suspect that they could apply the result of their studies to more profitable use than to weaving incoherent systems of hypothetical cobweb. They found that certain facts, which had passed the ordeal of demonstration, would combine together, and form coherent systems, but that they must be thoroughly cleansed from vague hypothesis. They found, by reflection, that some of the useful arts, which had thus far been kept under the guidance of bundles of foolish *arcana*, followed, as a blind man pursues a beaten path, but is instantly lost, if he gets out of it, were neither more nor less than illustrations of the principles they had discovered, applied to practice; and that many of those arts, if once properly conducted, afforded openings to sources of immense wealth. Science, from that time, began to assume demonstrative character and systematic form, and art to be conducted on scientific principles.*

The advancement of human knowledge had then began to feel a considerable accelerating impulse, from the invention of *printing*; and it was probably by means of this impulse, that the use of *steam*, as a motive power, and the art, or rather, the principle of *spinning*, by machinery, propelled by inanimate power, were discovered; and these two inventions, aided by the principles of science, may be set down as the pioneers to a field of knowledge in the arts, compared with which, all previous knowledge of those subjects, may be considered as seeds, contrasted with the display of luxuriant vegetation. These discoveries, as they have been applied to, or have called into requisition different branches of the arts, have given new impulse, new forms, and new modes of operation, which, without them, would probably never have been thought of, or believed practicable, had they been proposed. Could the most ingenious mechanic, of 150 years ago, go into a machine shop, or a cotton or woollen manufactory of the present day, he would be lost in amazement, and believe it all to be magic.

But this world of improvements, though more or less apparent in every branch of useful art, has displayed its most wonderful effects, in the various productions of the spindle and the loom; and, in this department, mostly in fabrics from cotton and wool. In linen, little has been effected; and though an immense field is open, circumstances appear disposed to defer occupying it till some future day. In silk, some improvements have been made, in Europe; but, in that also, a wide field is presented.

In the United States, the cotton business is now fairly introduced; and the woollen, except that branch denominated *worsted*. These branches have already opened a source of profitable and respectable employment to a numerous class of our citizens, as machinists and millwrights, who, in consequence of those very gifts of nature, which now render them the ornaments, and their works the boast of society, would otherwise have remained as they were formerly, idlers and drones, and rather despised than respected. But besides these, a still more numerous host are employed by these branches as carders, spinners, power-loom tenders, boarding house keepers, traders, and many others, who are now maintaining themselves in comfortable circumstances, and enriching the nation by their labors; who, but for these branches, would, most of them, now be pining in obscure poverty and wretchedness.

How much it behooves us then, on every principle of patriotism and national policy,

* This was strongly exemplified by Mr. Chaptal, in the process followed in dying the Adrianople, or Turkey red. He found, that out of 23 distinct operations, strictly enjoined in the formulæ, by which the dye was effected, three only had any effect on the process; the others were mere blind guide-posts, by which they had groped their way, till they had blundered upon the true result, by accident.

as well as pecuniary self-interest, if we can open another field of equal or similar importance, from which to reap such a harvest of prosperity, to lose no time in doing it, but to set about it with energy.

And such is the field now open, and courting our occupancy, as well in the culture and manufacture of silk, which promises equal benefits, as in the business of manufacturing worsted, which, if not an object of equal magnitude, will probably be equally beneficial, as far as it goes. The spirit of the country is now awake to engage in the culture of silk; and we have not only the means, to the most unlimited extent, but we have advantages superior to those which any other nation ever possessed. The business of manufacturing *worsted* will prove a highly important branch, both to the manufacturing and agricultural interest, and the rapid march of improvement, both in the quantity and quality of wool, bids fair to afford a better selection for the purpose than can be found elsewhere.

It is, perhaps, a fair estimate to say that the value of all the property in the United States, except what is exclusively engaged in commerce, is now double what it would have been, without the manufacture of cotton and wool, and the profits of producing the raw materials for both. If this position be true, the *establishment* of silk and worsted will, in the same length of time, produce at least as great an increase.

It is sometimes asked, "Should the United States go with avidity into the production of silk, would not the business be overdone?" To this I would answer: If we take into consideration these facts, which are well established, that the American silk is superior in quality to that of almost any other country; that we have an exhaustless supply of land, peculiarly adapted to the production of silk, at a price scarcely worth taking into the account; that England alone buys raw silk to the annual amount of about $10,000,000 —nearly all of which she will purchase of us, because, for the reasons just mentioned, our silk will be the best and cheapest; and also, that our own population, which now consumes, annually, $12,000,000 worth of manufactured silk, is rapidly increasing, and the increase of wealth will, doubtless, cause more silk to be worn in proportion to the numbers; from all these circumstances, I should think there would be about as much danger of overdoing the silk business as of the Hudson River becoming useless by the water all running out.

The business of producing and manufacturing silk is naturally divided into three distinct branches: 1st, rearing and cultivating the mulberry trees; 2d, feeding and attending the worms till the cocoons are finished; 3d, reeling and manufacturing the silk; and though many will unite the two first branches, and some all three, it will be found ultimately that the greatest profit will result from pursuing the branches separately. The agriculturist, in connection with his other concerns, will find the mulberry tree a most profitable article, especially as the most suitable land is such as would be of little value for other crops. The leaves may be sold, like any other produce, to those who rear the silkworms; or if he has a wife and daughters, they may carry on the second branch, and sell their cocoons to the manufacturer. The manufacturing of silk will be, at least, as profitable as of cotton or wool, and perhaps more so; and will open a new and extensive demand for machinery, and give a new impetus to inventive genius, as well as to skilful execution. In illustration of this part of the subject, I will here give the testimony of *Stephen Wilson*, a *silk manufacturer*, taken before a Committee of both Houses of the *British Parliament*, on the subject of the *silk trade*, and *silk manufacture*, in the year 1821.

Mr. Wilson says, "Nearly two millions of raw and thrown silk are annually imported into England; it gives employment to 40,000 hands, in throwing it for the weavers, and their wages are $1,554,000. Half a million pounds of soap, and a large proportion of the most costly dyestuffs are consumed, at a farther expense of $1,332,000, and $1,176,600 are paid to winders to prepare it. The number of looms may be taken at 40,000, and the weavers, warpers, me-

chanics, &c., will employ 80,000 more persons, and their wages will amount to $13,120,000. Including infants and dependants, 400,000 mouths will be fed by this manufacture, the amount of which I estimate at $44,400,000."

It would be impossible to set down, with any certainty of correctness, the extent to which the worsted manufacture would be carried; but it would, perhaps, be safe to reckon it the next most important branch, after cotton, silk, and wool.

The worsted business is already commenced at Lowell, that metropolis of useful enterprise, and every true-hearted American must sincerely wish it success. It will probably soon awaken, in the wool-growing community, a spirit of laudable emulation, in producing long and fine wool, a description hitherto of no peculiar value in this country. The machinery in this branch will be nearly the same as that used for spinning cotton; as it is spun on the same principle, only a little varied in the application. The quantity will be a most essential object in the machine making department.

In the production of silk, the agriculturist may raise, from a given number of acres of his poorest and most wornout lands, probably double the value, in mulberry leaves, that he could obtain from twice the number of acres of his best land, in any other crop; and his women and children can harvest it. The women and children, employed in hatching and feeding silkworms, will find an unlimited field of employment, more profitable than any they have ever engaged in. The man of wealth and enterprise will find, in manuf facturing it, a safe, profitable, and almost boundless investment for his capital, and if he is a philanthropist, he will have the additional satisfaction of dealing to thousands of his fellow-creatures the sweet reward of industry. In the mechanical department, also, as I have already stated, an immense field will be opened, not only of profitable employment, to the industrious and skilful mechanic, but of liberal encouragement to inventive genius.

From all these considerations, it becomes the imperative duty of all the above named classes, not merely to express their wishes, but actually to exert their utmost power to forward the introduction of these two important branches. Let the agriculturist immediately set about producing mulberry trees, and the wool-grower obtaining long fine wool. Let every woman, who has a moment's leisure, set herself industriously to obtain the means of beginning with a few silkworms, and of providing for their future increase; and let every enterprising mechanic do all in his power to facilitate the introduction of silk and worsted, and they will soon see the commencement of a second distinct era in the progress of American improvements.

ARCHIMEDES.

[For the Mechanics' Magazine.]

Lowell, Mass.—Its Manufactories, &c.

The town of Lowell, in Massachusetts, is about four miles square; and fifteen years ago, contained but a few families, of honest farmers, who obtained subsistence for themselves, by cultivating the barren soil, and by fishing in the adjacent streams. It is situated at the confluence of Concord and Merrimack Rivers, and was formerly called Chelmsford Neck, and originally by the Indians, Wamaset. It contains at present about fifteen thousand inhabitants.

In 1819, Kirk Boot, Esq., a merchant of Boston, discovered its resources, and, in company with several others, purchased the land and water privileges. They were incorporated by the name of the "Proprietors of the Locks and Canals on Merrimack River," and commenced operations by digging a Canal from Merrimack River near Pautucket Falls. This Canal is sixty feet wide, and the depth of water eight feet.

This Company has a capital of $600,000, and employs about 200 workmen in their machine shop.

The first manufacturing company, in respect to age, and amount of capital, is the Merrimack. It has a capital of $1,500,000, and five large brick factories, containing in the whole 26,000 spindles, and 1,000 looms. There are employed in it from three to four hundred males, and from eight to nine hundred females.

1,500,000 lbs. of cotton are used in it annually. It manufactures yearly 6,500,000 yds. of bleached and printed goods. This Company was incorporated in 1825.

The Hamilton Manufacturing Company has a capital of $900,000, three large brick factories containing 16,000 spindles, and 500 looms; employs 700 females, and 200 males. It consumes 3,500 bales of cotton yearly. Twilled goods, cailcoes and fancy articles are manufactured in these factories.

The Appleton Manufacturing Company has a capital of $500,000, two large brick factories, 9,500 spindles, 350 looms, and employs 60 males and 470 females. It uses 1,500,000 lbs. of cotton yearly, and makes about 4,000,000 yards.

The Lowell Manufacturing Company has a capital of $600,000, one factory for cotton goods, containing 4,000 spindles, and 132 looms. It consumes about 1,000,000 lbs. of cotton, and makes 2,184,000 yards per year. This Company has also a carpet factory, where they make 3 or 400 yards per week. It manufactures the Kidderminster and Brussels carpets, and beautiful rugs of various descriptions. They employ 175 males and 200 females, in both mills. Incorporated in 1828.

The Middlesex Manufacturing Company, with a capital of $500,000, has one factory in operation, containing 3000 spindles, 62 cassimere looms, 238 for broadcloths, employs 145 males and 240 females, and consumes 400,000 lbs. wool, and maks 200,000 yards cassimere and broadcloth annually. Incorporated in 1828.

The Suffolk Manufacturing Company has a capital of $450,000. Two brick factories, 10,240 spindles, 352 looms, employs 70 males and 440 females. It makes twilled goods, and uses from 4,160 to 4,680 bales of cotton annually. Incorporated in 1830.

The Tremont Manufacturing Company has a capital of $500,000, two brick factories, with 11,136 spindles and 410 looms. It consumes 170,000 lbs. of cotton, and makes 600,000 yards of cloth annually. It employs about 550 persons. Incorporated in 1830.

The Lawrence Manufacturing Company has a capital of $1,200,000, four large brick mills, 24,000 spindles, and 700 looms. This is perhaps the most elegant building in town. About 1,160 persons are employed in it. Incorporated in 1830.

In addition to the above, there are some important establishments, among which are, the Belvidere Manufacturing Company; incorporated, but not organized. It employs about 70 operatives, and manufactures about 5,000 yards of flannel per week.

The Lowell Bleaching; capital $500,000, employs 30 hands, and bleaches 124,000 yards per annum.

About a mile up the Concord River are extensive powder mills, owned by O. M. Whipple, Esq., in which are made 30,000 kegs of superior powder annually.

The Lowell Brewery, incorporated in 1828, with a capital of $50,000; and a worsted manufactory has just been commenced by Mr. Simpson, which employs 125 persons, and works off 1,000 lbs. of worsted per day.

It is also said that a Company is already formed, which has commenced purchasing cocoons, with a view of establishing a Silk Manufactory; and that the buildings are to be erected the ensuing spring.

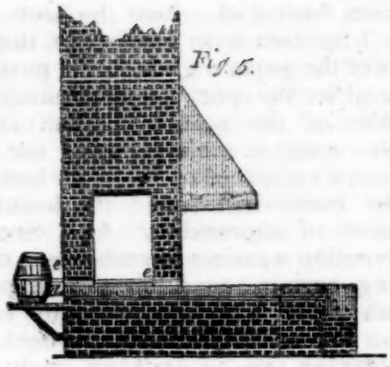
Lowell contains ten houses for public worship, three banks, a theatre, two large brick schoolhouses, and primary schools are located in every section of the town, and open at all times to the free access of the rich and poor.

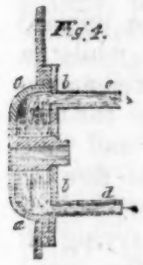
There are in the whole about twenty-five factories in operation, and there yet remain unoccupied privileges for nearly as many more. When these shall be taken up, as they probably soon will be, they will furnish the means of subsistence to about another 15,000 inhabitants, which will make, in the whole, 30,000, and we see no good reason to believe that this number will ever be much exceeded.

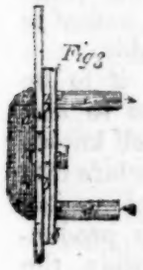
A Railroad from Lowell to Boston is now completed, and the distance of 26 miles is travelled in from 55 to 65 minutes, including stops—and promises to be of immense utility to both places. There are two tracks, and it is said to be more permanently built than any other in the country.

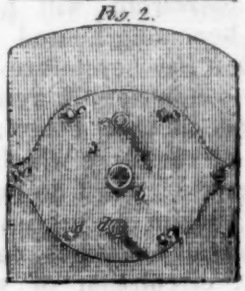
S. B.

JOHN WEST'S IMPROVEMENT ON FORGES.









[From the Repertory of Patent Inventions.]

Specification of the Patent granted to JOHN WEST, *of Kensington, in the County of Kent, Blacksmith, for an Improvement on Forges.* Sealed December 9, 1834.

WITH AN ENGRAVING.

My invention consists in causing water to circulate within the back of the forge in order to carry off heat therefrom, whereby the back of the forge will be preserved from the prejudicial effects of the heat, as will be hereafter fully described.

Description of the Drawing.

Fig. 1, represents a front view of a forge back, which is made hollow in order to admit of a flow of water.

Fig. 2, is a back view of fig. 1, by which the position of the circulating pipes is shown.

Fig. 3, is a side view of a forge back; and

Fig. 4, is a side section by which the action of the water will become more evident, the arrows in this latter figure clearly indicating the flow of the water.

In each of these figures the same letters indicate similar parts.

It will be seen that the back of the forge is made up of the parts *a* and *b*, the part *a*, being the front or part against which the fire or hot coal lies, and is consequently that part which is liable, in the ordinary back, to be quickly destroyed, but when constructed in such a manner as to admit of a constant flow of water against the back surface, this part *a*, will be less prejudicially acted on by the hot coal, owing to the heat being constantly conveyed away by the circulation of the water. The part *b*, constitutes the back part of the forge back. These parts are put together by screws, *c*, as shown in the various figures, there being packing or luting at the joints in order to keep the same water tight. *d*, is the induction pipe, and *e*, is the eduction pipe, which respectively lead from and to a tub or vessel containing water, which is placed in any convenient situation in order that water may constantly flow to and from the hollow forge back, *a*, *b*, as is clearly shown in fig. 5. I would here remark, that the hollow forge back is to be set in like manner to ordinary backs of forges, and in other respects the forge is constructed as heretofore.

Having thus described the manner of applying my invention, I will shortly state the way in which it acts. The

heat of the fire against the part *a*, of the back of the forge will quickly heat the water contained in the hollow forge back, the consequence of which will be that the hotter particles will rise upward and flow off by the pipe, *e*, whilst a quantity of colored water will constantly flow by the pipe, *d*, to make up for that which flows off by the pipe, *e*, and thus will a continued circulation or flow of water take place in the hollow back of the forge, which, continually carrying off heat therefrom, will prevent the forge back becoming heated to that extent to which it has heretofore been liable.

In conclusion, I would wish it to be understood that I lay no claim to any parts of the forge which are well known and in use; and I do hereby declare that what I claim as my invention of an improvement on forges, consists in producing a circulation of water within the forge back, as above described. In witness whereof, &c.

Enrolled June 9, 1835.

Fig 2

Fig 1

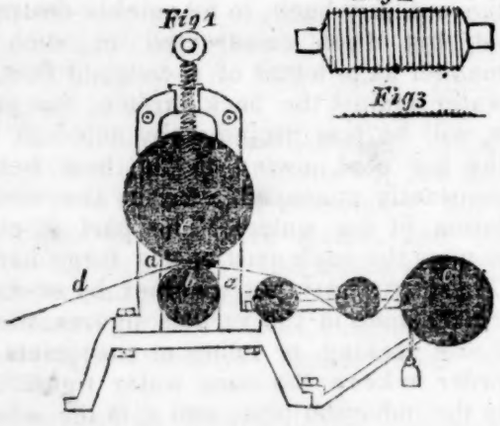


Fig 3

[From the Repertory of Patent Inventions, &c.]

Specification of the Patent granted to THOMAS DE LA RUE, *Fancy Stationer, for an Improvement, or Improvements, in Manufacturing or Preparing Embossed Paper Hangings.*

WITH AN ENGRAVING.

To all to whom these presents shall come, *Now know ye*, that I, the said Thomas De La Rue, do hereby declare the nature of my said invention, and the manner in which the same is to be performed, are fully described and ascertained in and by the following description thereof, reference being had to the drawing hereunto annexed, and to the figures and letters marked thereon (that is to say:)

Some attempts have been made to use embossed paper for the purpose of covering rooms in the way of paper hangings, but owing to the damp produced by the paste required in affixing such embossed paper to the walls, or to canvass or boards covering walls, must of the beauty of the embossing has been destroyed. Now the first object of my invention is so to prepare the back or part of the paper on which the paste is to be placed for the purpose of sticking it to the sides of the rooms in such manner that the water or moisture shall not affect the pattern embossed on the paper hangings, but the same shall retain its beauty and sharpness of impression. And, Secondly, my invention consists in embossing or impressing certain continuous and parallel lines on paper hangings, whereby to produce an increased brilliancy of effect of the light playing on or striking such paper hangings, and at the same time an evenness of color not observable in any embossed paper hangings heretofore manufactured.

Having thus stated, generally, the objects of my invention, I will proceed to describe the manner in which I carry the same into effect. Before having the paper embossed, when about to be prepared according to the first part of my invention, I size the back, or the side, which is to receive the paste, with a strong animal size (glue dissolved in water in the proportion of one pound in weight to a gallon of water) by means of a brush similar to those used by paper stainers, snd permit the same to dry. The paper is then to be embossed as is well understood. I then lay on, by means of a brush, one or more coats of the spirit-varnish and oily materials hereafter described, over the back of such embossed paper, taking care that all parts are well covered, by which means the water contained in the paste which is used in sticking on the paper to walls or canvass, or wood covering of walls, will in no way injure the embossing or pressed lines formed on the paper, and thus will the embossed face of the paper retain its beauty and sharpness of embossing when pasted on to a room. And the materials I prefer to use for this purpose are as follows:—One pint of good drying oil, one pint of turpentine, one pint of japanner's gold-sizs, and ten pounds (in weight) of white lead previously ground in oil: these are to be intimately mixed together, and, as aforesaid, be laid evenly over the back of the embossed paper hangings, in one or more layers, the quantity requisite being readily discovered by a little practice: the great object to be obtained is so to cover

the back surface of the embossed paper hangings that the water contained in the paste shall not penetrate to the face, and thus destroy the sharpness and beauty of the embossing. The paper so prepared is to hang in drying-rooms at a temperature of about 75° or 80° of Fahrenheit, and in case of more than one coat, each coat is to be dried before the next is laid on. The second object of my invention is the embossing or impressing a series of lines parallel to each other, and in the way of the length of the paper hangings, that is to say, that when such paper hangings are applied to a room such lines shall be at right angles to the floor; the object of which lines is to obtain a more brilliant effect of the light playing or acting on paper hangings so prepared, that when the surface is flat or prepared by ordinary embossing, or what are termed waterings, like silks.

In order to carry this part of my invention into effect, I take paper hangings, either plain or with their intended designs printed thereon, and pass them between rollers, one of which is engraved with a series of parallel lines, either right lines or lines slightly waved, provided such lines run continuously in the length of the paper hangings, and in such manner that such lines, when the paper is stuck on rooms, shall run at right angles to the floor, supposing the floor to be horizontal.

Description of the Drawing.

The drawing, fig. 1, hereunto annexed, represents an ordinary embossing press; *a*, being the framing; *b*, the embossing-roller, shown separately in fig. 2; this roller has engraved or cut thereon a series of lines or grooves, such lines being parallel to each other, and when used for embossing paper, will produce thereon a number of lines in the way of the length of the paper, so that when such paper hangings are pasted on a room these lines will be at right angles to the floor, the consequence of which will be that the light playing on such paper will have a very peculiar and brilliant effect, such as cannot be obtained by lines passing in any other direction, and by this means much greater elegance and evenness of color and effect may be produced, even in common as well as the better class of papers. The paper hangings, thus embossed, are then to be prepared on the back, in like manner to that above described for preparing ordinary embossed paper hangings. It may be desirable here to remark, that where it is wished to have what are termed watered embossed papers, or any other embossed pattern produced according to the second part of my invention, then the engraving for that purpose on the roller must have the ground of parallel lines running in like manner around the roller, the patterns or designs being engraved in addition to such series of parallel lines, which are to run in the way of the length of the paper, and to be stuck to the walls of rooms in such manner that such lines shall stand at right angles to the floor, supposing such floor to be perfectly horizontal.

Having thus described the nature of my invention and the manner of carrying the same into effect, I would have it understood that I lay no claim to the embossing of paper, such process being well known and in use for book-binding, paper hangings, and a variety of other purposes: nor do I claim the parts of the apparatus shown for giving the line as above described: but I do hereby confine my claim of invention, First, in preparing the back of embossed paper hangings with *spirit* or *oily* substances suitable for resisting the moisture contained in the paste used for sticking such paper to the walls of rooms, whereby such embossed paper hangings will retain the sharpness and beauty of the embossing; Secondly, I claim the production of paper hangings with embossed parallel lines in the way of the length of the paper, that is, in such manner that when the paper hangings are pasted on to walls, such lines run upwards at right angles to the floor, as above described, and whereby an increased beauty of effect will be obtained from the light playing or acting on the surface of such paper. In witnesswhereof, &c.

Enrolled February 14, h835.

[From the Journal of the Franklin Institute.]

On Steep Grades for Railroads. By A. C. Jones.

Gentlemen:—In reading the reports of new Railroads that are being located, I have been surprised to see that Engineers propose grades of one hundred feet to the mile, and state that locomotive engines will overcome them with ease;* this being only the case when the greater part of their load has been left behind, or when the assistance of another engine is afforded to aid the first one up the grade.

Inclined planes, with stationary engines, are serious evils on Railroads, and where the plane is such that it requires the power of another locomotive to surmount it, the evil is only lessened: far better would it be for the stockholders, if the Engineer should

*I have not seen the official account of the experiment of ascending the one hundred and seventy-six feet grade, on the Baltimore and Ohio Railroad; but it is not prudent to take a single experiment as a basis by which to form grades.

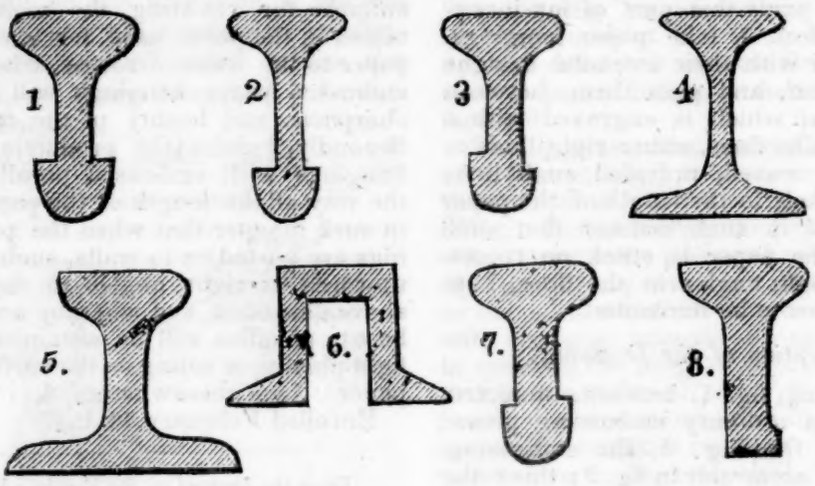
lengthen the road five miles, than to make a grade over thirty feet to the mile. Where the carrying trade is all one way, there is an exception to this remark, but then such grades are not consistent with safety.

It will be admitted by all, that the state of the water in the boiler of a locomotive engine is of considerable importance, and any person who has seen locomotive engines, with boilers of Mr. Stephenson's plan, will not have failed to notice the great change in the height of the water in the boiler, in passing from a level down a grade of twenty-five feet to the mile. This is easily accounted for, by the angle which the grade makes with the horizon, and as the water in the boiler will find its level, it flows to the lowest end: moreover the centre of gravity being thus moved forward, increases the weight on the springs in front, which are straightened in proportion, while part of the weight being removed from the hind part of the carriage, the elasticity of the springs will raise it up, and the cap of the fire box, and part of the flues, are liable to be left dry.

It may be urged by some, that the ebullition in the boiler will keep the flues wet; but as it is known, that in descending a grade exceeding one hundred feet, no steam will be required, and there being consequently no draught, the water will not be in violent ebullition.

Respectfully yours,
A. C. Jones.

Portsmouth, Va., Aug. 20th, 1835.



[From the same.]

Sections of Rails used in the United States.
By J. C. Trautwine, *Civil Engineer.*

Gentlemen,—I send for insertion in the Journal of the Institute, transverse sections of eight varieties of parallel rails, employed on different Railroads in the United States. The figures are drawn to a scale of one fourth the full size, and accompanied by a statement of the weights, per lineal yard.

		Weights.
No. 1.	Columbia and Philadelphia, per yard,	41½ lbs.
2.	" " "	33 "
3.	Germantown and Norristown, "	39 "
4.	Camden and Amboy, "	39¼ "
5.	Boston and Providence, "	54 "
6.	Wilmington and Susquehannah, "	40 "
7.	Alleghany and Portage, "	40 "
8.	Boston and Providence, "	40 "

[From the Boston Mechanic.]

Native Artists and the Arts.—Perhaps the better way to cherish native ingenuity and enterprise would be, not to impose a tariff on foreign productions, but to be willing to encourage those of our own land, even at the risk of paying a higher price for them than for the foreign article; which will be the sure way to make them, by and by, cheaper, as it will so much the better enable the producers to work upon a more extended scale, and consequently, with greater facilities.

The more common trades, which require, comparatively, the exercise of little skill and little intellect, will get along well enough; but would we encourage the higher branches of the arts among us, we must assuredly take good care of the artists. It can hardly be expected that one should be able to acquire fortunes, in a business the acquisition of which, even to mediocrity, is a labor of many years, requiring much capital, as well as extensive study, research and experiment, for its successful prosecution, and the proceeds of which, after all is done, must be costly—and often not only so, but having

necessarily a limited demand, as is the case with philosophical and astronomical instruments, —unless some peculiar encouragements should be afforded by efficient patrons of the liberal arts and sciences.

Nevertheless, these articles must be had, and made, by somebody. Somebody must take upon his shoulders the expense, and incur the difficulties which lie in the way of their successful construction. In this country, the prosecutors of these branches of art, as well as the cultivators of the sciences, have a great disadvantage compared with those of the old country. There is here no *royal* favor, no royal munificence, to be lavished upon the deserving or the undeserving; there are no royal patrons of the arts and sciences, ready to bestow both their sanction and their guineas upon the makers of important improvements and discoveries. Unwilling as we plain republicans are, to allow a grain of superiority to kingly governments, we are obliged to confess that however they have oppressed their people, they have been efficient promoters of science and the arts.

But our native pride will, we think, prevent us from answering in the negative the question—'Are we not able to give as ample support to *these* pillars of civilization, as we are to our boasted freedom, and to the rights of man?' And if this question be answered—'Yes,' we believe it will be truly answered. Why is not our *government* able to bestow as efficient patronage on scientific research and discovery as the royal associations, which so liberally dispense rewards and favors in Old England?

But it is true that science and the liberal arts have not met, in this country, with that encouragement which is necessary to their prosperity. The best and almost the only *general* standard scientific journal among us, has languished, for want of aid. Our artists have preferred even to leave the land of liberty, for the sake of finding a clime where they might reap a profit from their labors.

But it will not be so always. If the disasters of another revolution should not suddenly overtake us, (which may God avert,) we cherish a hope of soon seeing the ways of knowledge and scientific research as profitable, and as generally honored, as the less intellectual pursuits which so absorb the minds of a great portion of us. Nor do we fear that in heaping rewards upon the pioneers of useful knowledge, in its high and difficult departments, we shall the more degrade those by whom these honors are unattainable. No! we are assured, on the contrary, that before these heralds of science can be, among us, suitably rewarded for their exertions, the people must be *raised*—not depressed; instructed—not fettered in ignorance; taught enough of science to respect it for its own sake, instead of bowing down blindly and wonderingly before its possessors.

We regard, then, the education of the people, and the cultivation of the higher branches of science and art, as causes which must go hand in hand, and stand or fall together. The *people* are sovereign here; and what kings are not here to do, with their royal munificence—perhaps extravagance—the people must do by their liberality and patriotism. They who give law to the land, must give strength to the wings of genius, and themselves urge forward the wheels of research and invention, if they would see the temples of science and art, rising beside those of liberty. A——z.

[From the same.]

Illuminated Street Signs.—Messrs. Editors:—I wonder whether it is because everybody that can reasonably be expected to be interested in city improvements, knows all the streets by heart, that no attempt has ever been made to render the names of the streets at the corners, visible in the night-time. Were lamps hung against those signs—and that would be, as far as I can see, as good a place, for all other purposes, as they generally occupy—the evil would at once be remedied. In England, where they go a-head of us in every thing, except in the matter of the freedom of the people, &c., of which we are wont to boast, they have contrived the plan of embossing or painting the names of the streets on the cross-bars placed for the lamp-lighters' convenience at the top of the lamp-posts. The sides of the said bars being slanted off somewhat from above, the light from the lamp falls down and illuminates the name, so that it may be read. It might be well,

I think, for some of our wiseacres to meditate profoundly for a while on this subject, laying by, for a season, perpetual motion and cooking stoves, of which articles there is already an abundance in market. MORE LIGHT.

EXPLANATION OF TERMS.—There are those who would read works on natural philosophy, were they not deterred by meeting with words which they cannot understand; of some of which they might search in vain for a satisfactory explanation in our common dictionaries. One is, however, by no means justifiable in declaiming against the use of technical terms; which cannot always be avoided, in the plainest treaties upon many scientific subjects. Those who wish us to bring every thing down to their comprehension, lay themselves open to the suspicion of being, in fact, too indolent to climb to the height which the subject ought to occupy; or at least, we must suppose them forgetful of the fact that in treating of things not commonly spoken of, we must sometimes employ words not commonly made use of.

The following explanations of terms in frequent use in scientific and practical treaties, will, it is believed, be found both useful and clear. The list may perhaps be hereafter extended.

Specific Gravity.—The difference in weight of equal bulks of different substances. See a particular illustration in No. 3, (May,) 1835.

Square.—In arithmetic, the product of a number multiplied by itself, as 25, which is 5 times 5; 144, 12 times 12. The numbers 5 and 12 are also called the square roots of 25 and 144 respectively, and so on.

Square of the Distance.—Certain things, in philosophy, as the force of gravitation or attraction, and the intensity of light, are said to decrease in the ratio of the *square of the distance.* The meaning is this:—Suppose a body to be placed, say two feet from a light, or the centre of an attracting body, as a magnet, and another body 4 feet from the same. These bodies will be attracted, or illuminated, not in proportion to their distance, that is as 2 to 4, or in a double ratio, but as the *squares* of the distances; viz, as 4 (the square of 2,) to 16, (the square of 4,) that is to say, in a quadruple ratio; and in the same manner, if the second body was removed 10 feet off, it would be illuminated by the light, or attracted by the magnet, only in the proportion to the former of 4 to 100, (10 × 10.)

Gravitation.—Attraction; applied exclusively to the attraction of the earth for bodies falling towards it, and that of the heavenly bodies for each other.

Centrifugal Force.—A force tending to throw any thing revolving, from its centre of motion, as water poured on a grindstone is thrown off, when the stone is turned rapidly.

Centripetal Force.—That which tends to draw a revolving body *towards*, or *hold* it near the centre of motion, as a string retaining a ball whirled in the air by the hand.

Oxyde.—Rust. A mixture of oxygen with metallic substances.—[Boston Mechanic.

INTERESTING EXPERIMENT.—A bar of iron heated to whiteness, being held against a strong current of air from the blowing apparatus of a forge, instead of cooling, as might have been expected, burned brilliantly, throwing off scintillations in every direction. The editor of the Scientific Tracts, who relates the account, does not undertake to account for it; but it is evident that the additional oxygen thus forced upon the already ignited metal, promoted the continuance of the cumbustion, chemically, in a much greater degree than its cooling power retarded it.—[Ibid.]

THE AXE.—The power of the American Axe (says Latrobe in his book on the United States,) and the skill with which it is wielded, may well excite the admiration of a European. The weapon itself is no more to be compared with the vile copper commonly seen in the hands of one of our woodmen, than a gimblet can be compared to a centre bit. It is formed upon a different principle—the handle is set far forward, and it acts upon the tree, more from the wedgelike form, its own weight, and the skillful swing which gives it impetus, than from any great exertion of strength on the part of the woodman. In fact slight more than strength is employed in its use. The rapidity with which the huge trees of the forrest fall before a single pair of well swung axes is really marvellous; and the axe may rank with maize and steam as one of the three things which have conquered the Western World.

[From the Journal of the Franklin Institute.]

Essays on Calcareous Cements. By JAMES FROST, *Esq., Civil Engineer, New-York.*

Sir,—Having, many years since, in my native country, [England,] formed various calcareous cements, of a beautiful color, by a new process, which cements appeared to be very hard, and to become more so, I was desirous of comparing them with other hard substances, and of obtaining, if possible, their relative value, without injuring the specimens. This object was satisfactorily attained by abrading them, by means of fine emery and water, against a standard piece of white statuary marble, and calculating their relative hardness from the weight lost by each substance in the operation.

It soon became evident that the term strength would better define the result than the term hardness, which being an abstract quality, always in combination with another abstract quality, tenacity, jointly constitute strength, by which all change of form is resisted. Statuary marble was used as the test for all substances, from brass to work stone, inclusive, which latter substance was used to test the weaker articles, while the stronger were tested in succession with each other.

As another attempt to obtain similar information was recorded in the Annals of Philosophy, by Mr. Bevan, in the numbers for March and April, 1831, and as that gentleman operated on some of the same substances by percussion, and obtained thereby somewhat different results, a careful consideration of the two modes employed seems to indicate that percussion is rather a measure of tenacity, and abrasion a measure of hardness.

In measuring the minute differences of hardness in substances nearly similar, abrasion is evidently the only means of obtaining satisfactory results.

I shall defer the details relative to the strength of calcareous cements, which it is my intention hereafter to furnish, only stating, that I possees a collection ranging from 1 to 580; but I shall, in due course, enter fully on these curious and important distinctive properties. I shall thus place at your disposal the results of a long course of experiments, made on a large scale, with a view to improve the theory, formation, and useful application, of these interesting substances.

As there are few scientific subjects respecting which there are so many conflicting theories, and, amongst practical men, so many different opinions, you may perhaps consider an attempt at elucidation and improvement worthy of the attention of your numerous scientific and practical readers.

Comparative Strength with which various Substances resist Abrasion.

Hard cast-steel,	6014
——— yellow tempered,	3184
——— blue tempered,	1592
Soft gray cast-iron,	1293
Black flint,	1939
Rock crystal,	1600
Aberdeen granite,	980
Broner stoneware,	950
Yellow brass,	675
Wedgewood's evaporating basin,	600
Copper keg,	525
Hard Yorkshire paving stone,	327
Old blue Purbeck "	318
Italian black marble,	260
Forest marble,	200
Common unglazed earthenware,	193
Sienna marble,	177
Kilkenny black marble,	110
Statuary marble,	100
Old Portland stone,	79
Roman cement stone,	69
Roman cement, (12 months old,)	58
Fine grained Newcastle grindstone,	53
Welsh blue roofing slate,	41
Fluor spar,	39
Stock brick,	34
Calcareous spar, (Iceland,)	33
Wirth sand-stone, (Sussex,)	17
Coarse grained Newcastle grindstone,	17
Bath stone, (Oolite,)	12
Chalk at Barton on Humber, (Cawk,)	15
" at Dover, (fossil bed,)	6
Gypsum, uncabined,	5
Plaster of Paris, (3 months old,)	.40
Thames chalk,	.18

[From the Journal of the Franklin Institute.]

Alloys, Solders, and Amalgams, used in the Arts.

Gentlemen,—The following table of the alloys and amalgams used in the arts, has been prepared by Mr. Chaudet, a distinguished and experienced assayer in the mint of Paris, from actual analysis of carefully selected samples. In a few instances, the proportions of the composing metals are not given, for reasons that, in one instance at least, are obvious. This deficiency is more than compensated by the addition of several others, particularly that of the alloys of Palladium, which I have added, in the full persuasion that the whole will be found useful. Yours, &c.

FRANKLIN PEALE.

Table of Alloys, Solders, and Amalgams, used in the Arts.

Alloy of Gold Coin.—(French Standard.)		
Gold,	900	1000
Copper,	100	

Alloy of Silver Coin.—(French Standard.)

Silver,	900	1000
Copper,	100	

Alloy of "Billon."—(French Standard.)

Copper,	800	1000
Silver,	200	

Alloy of Gold Medals.—(French Standard.)

Gold,	916	1000
Copper	84	

Alloy of Bronze Medals.*

Copper,	92	100
Tin,	8	

Alloy of Jewellery.—(French Standard.)

Gold,	750	1000
Copper,	250	

Alloy of Silver Plate.†—(French Standard.)

Silver,	950	1000
Copper,	50	

Alloy of Gold Coin.—(U. S. Standard.)

Gold,	899.22	1000
Copper and Silver,	100.58	

Alloy of Silver Coin.—(U. S. Standard.)

Silver,	892.43	1000
Copper,	107.27	

Alloy of Gold Coin.—(English Standard.)

Gold,	916.67	1000
Copper and Silver,	83.33	

Alloy of Silver Coin.—(English Standard.)

Silver,	925	1000
Copper,	75	

Alloy in imitation of Gold.

Copper,	91.00	100½
Tin,	9.50	

Alloy in imitation of Silver.‡

Copper,	61.27	106
Zinc,	28.78	
Nickel,	15.13	
Lead,	.82	

Alloy for Cannon.§

Copper,	100	111
Tin,	11	

Alloy for Statues.‖

Copper,	91.40	100
Zinc,	5.53	
Tin,	1.70	
Lead,	1.37	

Alloy for Bronzes and Candelabras.

Copper,	82.00	104½
Zinc,	18.00	
Tin,	3.00	
Lead,	1.60	

Alloy for the Mounting of Fire-arms.

Copper,	80	100
Zinc,	17	
Tin,	3	

Alloy for Cymbals,* Tam Tams, or Chinese Gongs.

Copper,	80	100
Tin,	20	

Alloy for Bells.

Copper,	75	100
Tin,	25	

Alloy for the Reflectors of Telescopes.

Copper,	2	3
Tin,	1	

Alloy for Brass for the Lathe.†

Copper,	65.80	100
Zinc,	31.80	
Lead,	2.15	
Tin,	0.25	

Alloy of Brass for the Hammer.‡

Copper,	70.10	100
Zinc,	29.90	

Alloy for Types.§

Lead,	80	100
Antimony,	20	

Alloy fusible in Boiling Water.

Bismuth,	8	16
Lead,	5	
Tin,	3	

Alloy for Plugging Teeth.‖

Bismuth,	8.	17.6
Lead,	5.	
Tin,	3.	
Mercury.	1.6	

Alloy for Tinning Iron.

Tin,	8	9
Iron,	1	

Alloy used to make Ductile Gold of 18 carats, or 950 milliemes.¶

Copper,	990	1000
Gold,	10	

Alloy for Bells of Mantel Clocks.

Copper,	75	100
Tin,	25	

Alloy for the Pivots of Artificial Teeth.

Platinum,		
Silver,		

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* The medals made from this alloy are cast; they have the advantage of being struck by a few blows of the press, and of wearing a long time.

† The standard here indicated is the best; a second is composed of 800 of silver, and 200 of copper, in the 1000.

‡ This alloy is the Packfond of the Chinese.

§ In this alloy, small quantities of lead and zinc are often found, but they are present by accident.

‖ The proportions here indicated are the result of an analysis of the beautiful bronze statues of the garden of Versailles, which were cast by the Brothers Kellers, celebrated founders, employed by Louis XIV.

* This alloy is very hard; it is annealed by dipping, while red hot, into water, and is then malleable; whilst, if suffered to cool gradually, it is excessively hard; this important fact is due to M. d'Arcet, who has thus furnished the means of fabricating, in France, cymbals, &c., formerly imported, at great cost, from China.

† The proportions here indicated having been found by analysis, it is evident that the tin is present by accident.

‡ This alloy of brass is important, and is due to Mr. Chaudet.

§ Sometimes a small quantity of copper is added to these two metals.

‖ This alloy may be prepared with a smaller proportion of mercury; it melts at 65 deg. of the Centigrade scale.

¶ The previous combination of the alloy is found to produce ductile gold, when the same metals would prove the contrary, if mixed directly.

Alloy for ditto.¶

Palladium,	50	100
Silver,	50	

Alloy for the Springs of Artificial Teeth.*

Palladium,	50	160
Silver,	50	
Copper,	50	
Iron,	10	

Solder for Gold of 750, or 18 carats.

Gold of 750,	2.00	3
Copper,	0.50	
Silver,	0.50	

Solder for Silver of 750.†

Silver,	2	3
Brass,	1	

Solder for Brass.

Copper,	50	100
Zinc,	50	

Solder for Lead.

Lead,	2	3
Tin,	1	

Amalgam of Gold for Gilding on Metal.

Mercury,	91 to 89	100
Gold,	9 to 11	

Amalgam of Silver.

Mercury,	85	100
Silver,	15	

Amalgam for taking Impressions of Seals.‡

Copper,		
Mercury,		

Amalgam for Silvering Mirrors.

Tin,	70	100
Mercury,	30	

Amalgam for Silvering Globes of Glass.

Mercury,	80	100
Bismuth,	20	

Amalgam for the Cushions of Electrical Machines.

Mercury,	2	4
Tin,	1	
Zinc,	1	

Among the twenty-three metals that are not enumerated in the foregoing list, there are several that enter into alloys, but they are without utility in the arts; we should not, however, include in the remark, the native alloy of Osmiun and Rhodium, which is excessively hard, and is at present used for the nibs of metallic pens.

Care has been taken in the arrangement to name those metals first, which enter in the largest quantities in the alloy.

¶ This alloy is extremely important; it is used for all those purposes in the fabrication of philosophical instruments, for which platinum was formerly applied, being superior to it in hardness and color, and yet inoxidable under all the usual circumstances.

* An extremely useful alloy, having a degree of elasticity only exceeded by steel, with all the advantages of superior lightness and hardness over platinum; this, and the preceding, are due to Mr. Percival N. Johnson, of London.

† The copper and zinc ought to be taken in the form of brass; for two parts of silver, take one part of brass.

‡ This amalgam is hard, and melts at a low heat; it was used by the French police, under the administration of the celebrated Fouche, for the purpose of opening and resealing the letters that passed through their hands.

On the Praticability of Alloying Iron and Copper. By David Mushet, Esq.

In perusing, the other day, Dr. Lardner's third volume on metals,* I met with the following unqualified assertion: "As to alloying copper with iron, the notion not only appears absurd, but unsupported by evidence." As at the present moment Dr. Lardner's publication may be considered a text-book of popular instruction, such a statement might lead to a settled conclusion that to alloy iron and copper is, under all circumstances, impossible. Now the contrary is the fact; and having considered this operation for many years, as one which, if happily effected, would materially contribute to the perfection of many of our mechanical contrivances, I hope I shall be excused for entering on the subject somewhat particularly.

In the first place, I see no *prima facie* reason why it should be absurd to expect that iron should unite with copper as well as it does with other metals. Then as to the evidence, I think that most chemical works state the fact as a matter of course, never doubting the practicability of the measure; and in your own Magazine, vol. xlix., I find some experiments on the union of iron with copper; which shows that the subject has not been recently altogether overlooked. The uncertainty which prevails upon the subject arises from the want of accuracy in defining the nature and quality of the iron which has been the subject of the union. Most of the books entirely overlook the various states of iron, and fail to distinguish whether the subject-matter of the experiment was cast iron, or steel, or iron in a state of malleability. The same remark applies to the experiments of Mr. P. N. Johnson as above, who, though he states that he effected an union between iron and copper, yet leaves it doubtful whether the iron was not steel or cast-

* "Manufactures in Metal, vol. iii. Tin, Lead, Copper, Gold, Silver, and various Alloys," p. 174.

iron instead of pure or malleable iron. The well-known affinity of iron for carbon precludes the possibility of malleable iron being heated and melted in contact with a large dose of charcoal (as was the case in his experiments), without its passing into the state of steel, or cast-iron; so that the experiments of Mr. Johnson may be considered as representing, not the union of copper with wrought or malleable iron, but with cast steel or crude iron. Whether or not these were examples of a real chemical alloy, or of a mere mechanical mixture, may be gathered from the following remarks, which are grounded on an extensive series of experiments.

It had for many years appeared a desideratum to me to form castings for shafts, cranks, levers, beams, &c., of a substance that should possess the stiffness of cast, together with the power of tension and strength of wrought iron. It occurred to me that such a discovery would enable the engineer to construct more complete and convenient forms (particularly in the machinery belonging to steam-boats and locomotive engines), than he is at present able to obtain from the cumbrous forging, turning, and fitting of malleable iron. Such an union of strength I naturally sought for in a mixture of iron and copper; and knowing that the copper ores of this country are principally sulphurets of iron and copper, I commenced my experiments by attempting the joint reduction of the iron and copper. After many failures I so far succeeded as to effect a perfect reduction into malleable matter of the whole contents of any given sulphuret. But upon examining the results, it was found that a very great uncertainty prevailed as to their strength and quality; and I soon ascertained that I had only succeeded in obtaining a perfect separation from the ore, of the united products of iron and copper. These masses of alloy were arranged and classified as follows:

1st. Ingots of a coppery colored surface, covered with an exterior blackish shale in cooling resembling iron; breaking with a pale uniform homogeneous fracture, and producing an action more or less on the magnetic needle.

2ndly. Ingots with a gray coppery surface, covered also with an exterior blackish shale in cooling resembling iron, the under surface of a deep red coppery color. Fracture specular, and beginning to exhibit distinct grains of copper apart from the iron, as if this metal had been saturated with copper. Small hard and bright iron points appeared under the file. These ingots were obedient to the magnet.

3rdly. Ingots with an iron-colored surface, and coppery tints displayed under a black thin shale. Hard, and filing to a coppery color, mixed with bright spots. Fracture specular, exhibiting a mixture of iron and copper, in which the former appeared to prevail. Powerfully acted on by the magnet. The lower surface cellular and crystalized, resembling products of fused steel.

Though I have divided these products into three classes only, yet I obtained many intermediate results, the iron present in which I estimated at from 5 to 70 per cent. of the weight of the copper. Beyond 5 or 7 per cent. of iron, no chemical union took place; and as the quantity of iron revived, was in proportion to the charcoal added, so in the same proportion did the separation of the two metals from each other take place. From this it was inferred that malleable iron (*i. e.* iron containing the least possible quantity of charcoal), would unite and form a proper alloy with copper, but that steel or cast iron would not do so. To try the validity of this reasonioning, a new series of experiments was instituted, having for their object the direct union of a portion of copper with iron in various states of cast iron, steel, and malleable iron, the general results of which I will state as briefly as possible, without going into a detail of the various experiments.

Pure malleable iron may be united with copper in any proportion, until it equals, or even exceeds, the weight of the copper; the intensity of the copper color increases, till the quatities are equal; and the fracture then becomes paler, in proportion as the quantity of iron exceeds that of copper. With 50 per cent. of iron the alloy possesses great strength: its hardness increases with the quantity of iron, but its strength afterwards decreases, and in cutting, it opens before the chisel. The loss of strength in pro-

portion as iron is added, arises, I imagine, from the fibre of the copper being injured by the very high temperature required to fuse the increased quantity of malleable iron. The fracture of the ingots thus obtained is always specular, with a glance arraggement, which betokens a tendency to brittleness.

If steel is fused with copper in the proportion of one-twentieth of the latter to nineteen-twentieths of the former, an ingot resembling, and crystallized like, cast-steel, will be obtained, but useless for forge purposes, and incapable of receiving an edge. Not the slightest symptom of copper, either on the surface or in the fracture, can be perceived, but a very considerable increase of hardness may be observed.

When copper is fused with one-tenth of its weight of bar steel, an ingot is obtained which outwardly resembles the former, with the radiated linear crystallization less distinct. But the fracture, which is hard and brittle, shows, by minute points of copper, the commencement of an indisposition, or inability, to further union, or alloy, between the two metals.

Again, when one-fifth of the weight of copper is added of steel, an ingot is obtained, which exhibits, when filed, a partially coppery appearance, of a deep red on the lower, and steel bright on the upper surface. The fracture displays a regular grain, which indicates an intimate mixture of copper and iron, apparently of greater strength than in the two former alloys.

When one-third of copper is added to the steel, the former seems to separate, and sinks in considerable quantities, in a soft and malleable state, to the lowest part of the crucible. The fracture exhibits the copper in streaks and knots, indicating a decided want of union.*

White cast-iron, which resembles steel in the quantity of carbon which it contains, affords nearly the same result when fused with similar portions of copper; the alloy, however, possesses less strength, and a greater tendency to disunion when the proportion of copper is increased beyond one-twentieth.

The union of copper with gray cast-iron, if at all practicable, must take place in very minute quantities; for in fusing 5 per cent. of copper along with No. 1, or smooth-faced pig iron, specks of deep red colored copper were found upon the lower surface of the ingot, and similar traces were discernible in the fracture. With one-tenth the copper became of a deep red color, separated in leaves, and attached itself to the outside of the cast-iron; and when copper to the extent of one-fifth was tried, a solid bottom of copper was found beneath the cast-iron in the bottom of the crucible.

From all I have learnt on this subject, I conclude that copper unites with iron in proportion as the latter is free from carbon; hence it would appear impossible to produce a mixed metal, or alloy of copper and iron, by smelting in a blast furnace, in contact with carbonaceous matter, an ore containing both these metals. It is true that we have ores which, when properly smelted, would afford, at the first fusion, crude steel, which contains a minimum dose of carbon, and to which might be added as much copper as would chemically unite with it, probably from 5 to 7 per cent. But this quantity, I am afraid, would be too small, to form an alloy possessed of the strength and power of resistance necessary to make cas ings for the purposes already mentioned.

Though I have clearly established, by numerous experiments, the practicability of a perfect union of malleable iron with copper, in every reasonable proportion, yet as this alloy can only be made in a close crucible, it is obviously impossible to employ it for castings of a considerable weight or size. I do not, however, despair of overcoming this difficulty, and of gaining the object I have long had in view, by a different system of alloy, in which copper must necessarily form an essential ingredient.—[Rep. Pat. In.]

* Steel, both English and Indian (or wootz), was alloyed with copper, in the proportion of two per cent. of the latter, by Messrs. Stodart and Faraday, in their experiments on the alloys of steel; but of the value of this alloy, they observe, "we have doubts." They did not attempt to produce it in the large way. See Quart. Jour. of Science, vol. ix. p. 325, 329; and Phil. Mag. vol. lvi. pp. 31, 54; vol. lx. p. 371.—EDIT.

SUBSTITUTE FOR INDIGO.—A Company has been formed in London for the manufacture of a substitute for Indigo, from whose prospectus the following are extracts. "The objects of the Company are

to encourage the manufacture, and to bring into general use, the *British Substitute for Foreign Indigo;* and to dye wool, stuffs, cloths, silks, and other fabrics *blue or other colors* (for which indigo is now used), with this substitute, in the preparation of which a new and wide field will be opened to the industry of this country.—By the use of the substitute, a considerable saving will accrue to the manufacturer, and the colors produced, such as *blues, blacks, greens, bronzes, browns, and various others* will be so fast as to resist the action of *light, air, and friction.* The articles so dyed will not turn white at the *edges or seams*, a quality long sought after, particularly in stuffs or cloths for furnitures and other purposes, in which exposure to light and heat is inevitable, and hitherto has proved destructive of their colors. Independently of fastness, a brilliancy of color will be produced by the *substitute*, which cannot be attained with *indigo.*" "For more than half a century the first chemists of Europe have directed their best energies to the discovery of some means by which a perfect and uniform blue dye (other than indigo) might be obtained. Hitherto their researches have been unsuccessful, insurmountable objections presenting themselves in the caustic qualities of Prussian blue (the only known substitute) in some processes hardening the wool when dyed and rendering it difficult to work, and in others destroying its fibre. At length a process has been discovered, for which a patent has been obtained, effectually neutralizing the objectionable properties of the component parts of Prussian blue. A patent has also been obtained for the manufacture of the prussiates of potash and soda, rendering them fit for many purposes to which hitherto they have been inapplicable, whilst they are in every respect, in conjunction with certain ingredients, a perfect substitute for indigo as a dye for wool, &c. Facts which have borne the test of extensive experiment, demonstrate this substitute in all respects to be equal, and in many superior to, far exceeding in brilliancy and durability, any dye obtained by the use of indigo. By a new process (also patented) the wool may be dyed either in the flock, the fleece, the yarn or skein, or when woven into cloth. So also cotton, in skein or piece, silks and all organic substances, may be dyed with facility of any shade, and of a fast and durable color. The manufacture of hats may be materially improved by this discovery, because a most brilliant and fast color is produced by using the ingredients alluded to in the combination forming a black, which will resist the action of light and air, elements fatal to indigo. The materials of which the substitute for indigo is composed, are in great abundance both in England and Ireland, but at present they are in most instances wasted. Their conversion into prussiate would provide extensive employment to that class of society (particularly in Ireland) who stand most in need of it, viz., the most indigent, as will be apparent from the following observations. The articles alluded to are blood, horns and hoofs of animals, bones, fish, cuttings of leather, old harness, and all other kinds of animal substance, old woollens, the refuse of woollen manufactures, old garments, &c. Substances the best calculated for the purpose, such as blood, fish, &c., are not rendered less useful by being in a corrupt state, for even animal manure may be used with some advantage. It is well known that in Ireland, the quantity of cattle slaughtered for the Government service, for export, and for the supply of our mercantile marine, is very considerable. The blood of those animals is now almost all wasted, as well as a great quantity of other animal matter forming the offal. The same remark applies to many parts of England, where, in numerous instances, those really valuable substances are not only unproductive of benefit, but entail great expense in the very prevention of their being productive of injury. Whole cargoes of fish are frequently thrown away in consequence of their corrupt state. Inconvience and loss, therefore, are the least part of the argument, as their causes but too frequently contribute to engender sickness and contagious maladies; so that a demand for, and consumption of these substances, even in a corrupt state, would not only open a new source of employment to the poor, but would very materially tend to the salubrity of all the principal towns in the United Kingdom, freeing them from filth and contagion. This discovery, therefore, it is submitted, ought, if for this reason only, to be looked upon in a national point of view, as offering, among inferior benefits, certainly a new source of employment for the indigent classes of this kindgdom, and above all, a remedy against the accumulation of impure matter corrupting the atmosphere of our populous towns. The articles combined with animal substances in the preparation of the new dye, are potash or soda, acid, and iron. Any object causing an increased consumption of the first mentioned article would materially benefit the Canadas, and improve the situation of our emigrants in that quarter of the world, promising as it is at present. But should potash become scarce, soda will answer every pupose in the manufacture of the substitute for indigo, and an increased demand for that article might advantage the poor both

in England and Ireland, were they to be employed in converting salt into soda. The same observation applies to a new demand for acids, particularly since muriatic and sulphuric acids will be principally employed in these operations, and they are, almost exclusively, the produce of Great Britain. In reasoning on the foregoing observations, it may be necessary, 1*st*, To give a statement of the actual quantity and value of the indigo consumed; 2*dly*, To compare that value with the estimated cost of the substitute for it; and, 3*dly*, To point out some of the advantages which cannot fail to arise to our manufacturers from the use of the substitute. As regards the first, reference being made to Marshall's Statistical Tables, it will appear that the average annual quantity of indigo entered *for consumption*, from 1814 to 1831, both inclusive, was 2,438,245 lb.; that is to say, the quantity remaining, after deducting the quantity exported from the gross quantity imported, will give the average prefixed. But the same author states, that the quantity thus arrived at is not the true measure of consumption, since the stock on hand and in bond at the commencement of this era has been gradually decreasing. The average quantity consumed in Great Britain may, from these data and corroborating information, be taken at three millions of pounds per annum. The prices of the eighteen years aggregated give—

	s.	*d.*		*s.*	*d.*
For low qualities,	53	7	*a*	75	4
And for fine qualities,	178	2		204	0
	231	9		279	4
				231	9
				511	1

leaving, as a result from the general average of the eighteen years, a medium price of 7s. 1½d. per lb. The price of indigo is not lower than it was in 1831; whilst the manufacturers are now induced by experience to employ the finer description of indigo, finding their advantage in so doing exceeds economy in price. But as the valuable tables alluded to cannot extend to a perfect computation of the relative proportions of fine, middling, and low qualities, a mean price of 5s. per lb. will be assumed in the following observations, at which price the value of the indigo annually consumed would amount to £750,000. As regards the second and third remarks, it may only be necessary to state that the cost of the substitute need never exceed an average of 2s. per lb. It would thus produce an annual saving of £450,000, independently of the material consideration, that the gross amount of cost, £300,000, for the manufacture of thesu bstitute, would be expended on what is now wasted in this country, and in the labor of its poor inhabitants. The saving in the cost of the dye would enable the manufacturer to increase the wages of his workmen, or to sell the articles he may produce at a lower rate than those persons can who may continue to use indigo. The beneficial consequences would soon be felt in foreign markets, where English woollens are affected by a tariff on their declared value or cost of production, as in the United States of America, South America, Mexico, Hayti, and in some parts of the continent of Europe. There the British manufacturer would be enabled to undersell the woollen manufacturers of Germany, &c.; and this observation applies equally to cotton and other articles. At present the woollen manufacturers of Germany are underselling the British, in consequence of their purchasing indigo equally low, and procuring labor at a more moderate rate. In Ireland, formerly, an extensive manufacture of woollens was carried on; now, the greater part of those establishments are closed; but with capital (not large), and the advantages provided by the substitute for indigo, they might be put into a state of activity, giving to the population what chiefly they require—employment, to render them as industrious, peaceable, and contented as any subject in his Majesty's dominions. The subject is open to another important remark: Indigo is an article liable, in the event of war, to an immediate and a very considerable rise, by reason of an increased value of gold and silver, the increased charges for freight, insurance, and commissions, consequent thereto; whereas, the price of the principal ingrediems in the substitute for indigo would, in all probability, be decreased by the contingency becoming yet more abundant, in consequence of the extension of the Government contracts for salted provisions. The Government of France, under the Emperor Napoleon, offered a reward of one million of francs to the person who should discover a substitute for indigo in dyeing woollens. That offer cannot now be made available; but the King of the French takes a lively interest in this discovery, and would desire to reserve its advantages exclusively for France. Samples of wools and cloths dyed by this new process were exposed at the late public exhibition in Paris, and orders have been issued by the French Government to prepare with it cloth for the clothing of part of the French army. Samples of these cloths, and of wools dyed on the new plan, are now in London, and may be inspected at the Company's Office; as also samples of cloths and stuffs dyed in London, at

Messrs. Green and Whiteheads. Among these specimens are some literally worn threadbare—the color still as fresh as when first dyed. To revert to the question of economy, let it be observed, that, in using the substute for indigo, one pound of it will dye a] larger quantity of material than the like weight of indigo."—[Edinburgh Quarterly Journal of Agriculture.]

[From the Journal of the Franklin Institute.]

Report of the Committee on Science and the Arts, of the Franklin Institute, on Mr. J. K. Smith's Self-Acting Brake for Railroad Cars.

That this invention consists in a rod, or slide, attached to the front part of the frame of the car, which is pressed in whenever the car comes in contact with the one before it; the motion of this slide brings the brakes into contact with the wheels, by means of a suitable arrangement of levers, or by a chain passing around a pulley. As soon as the contact of the car ceases, the brake is freed, either by its own weight, or by a spring.

As Mr. Smith claims the principle of acting upon the brakes by the contact of the cars, and has proposed several different modes of effecting this, it is unnecessary to describe any particular arrangement.

The principal advantages of this invention are, that it will relieve the engine from the pressure of the train, when about to be stopped, and will prevent the hinder cars from rushing upon those in front, should their speed be suddenly checked by any casualty, and may thus prevent the lamentable effects with which these accidents are frequently attended. It occurred to some members of the committee, that these brakes might produce an unpleasant jerking when starting or stopping, and when travelling over a curved or an undulating road; but they are informed that several of them have been in use upon the Little Schuylkill Railroad for some months, and that no such unpleasant effect has been experienced. There is, however, one difficulty attendant upon the use of this contrivance, for which no remedy has been suggested. Whenever it becomes necessary to back the train, all the brakes must be thrown out of gear, and the time consumed in this operation may be of the greatest importance at a critical juncture. Notwithstanding this objection, the committee are of the opinion that the use of this brake will tend to diminish the danger of railroad travelling, and they would recommend a trial of it to those who are concerned in that mode of transportation, believing that it will be found worthy of their attention, both in a benevolent and profitable point of view.

By order of the committee.

WILLIAM HAMILTON, Actuary.

August 15th, 1835.

[From the American Railroad Journal.]

LONG LEVELS, WITH STEEP GRADES, in preference to a more uniform distribution through the whole line of the elevation to be overcome, appears to be the opinion of several of the most eminent Engineers in Great Britian.

We publish to-day several extracts from an examination before the House of Lords, of Mr. *Vignoles*, Mr. *George*, and Mr. *Robert Stephenson*, Mr. *Henry R. Palmer*, Mr. *H. H. Price*, and Dr. *Lardner*, in relation to the most judicious Grades for a Railroad. There appears to be but one opinion amongst them on the subject, which cannot be better expressed than in the language of Mr. Vignoles, in reply to the question, "Do you prefer the course of concentrating the inclination?" which is as follows, viz. "it is far better to keep the line as flat as possible, for a great length of time, and concentrate your power by having a stationary Engine, or an assistant Engine, to overcome it,"—(the inclination.)

We annex some remarks on the *London and Brighton* Railway, together with a table of Gradients of Mr. *Gibbs* and Mr. *Stephenson*, which differ materially in the distribution of the Grades.

We are indebted to Mr. G. Ralston, of Philadelphia, now in London, for these and other favors, for which he will please accept our thanks.

Remarks on the two proposed lines of Railway to Brighton.

Two lines of Railway to connect Brighton with London have been proposed separately by Mr. Gibbs and Mr. Stephenson.

Mr. Gibbs' line terminates at one point in London by the Croydon Railway, and at another by means of the Southampton Railway; Mr. Stephenson has subsequently, in his proposal for a Brighton Railway, fixed upon nearly the whole of Mr. Gibbs' line, but has adopted a different principle in planning his gradients.

The grand point of difference in the two lines is, that the gradients of the one, namely, Mr. Stephenson's, have the several rises and falls distributed over their whole length, whereas Mr. Gibbs has concentrated the rises and falls on *his* line in a few points, in order to obtain throughout the rest of the line either levels, or planes of such slight inclination, that practically speaking, they may be considered level.

The following table of the gradients on the two lines, will show that Mr. Gibbs has almost entirely confined his ascents and descents to three short planes, while Mr. Stephenson has distributed nearly the whole of his over 33 miles, with an inclination of 1 in 330.

Table of Gradients.

Mr. Gibbs' Line.

Miles.	Chains.		Feet per Mile.
11	56	Level.	
3	10	1 in 1002	5 3
6	18	1 in 1188	4 4
5	0	1 in 1028	5 2
3	36	1 in 114	46 3
2	31	1 in 107	49 4
5	5	1 in 2138	2 6
2	31	1 in 111	47 8
8	0	1 in 1289	4 9

Mr. Stephenson's Line.

Miles.		Feet per Mile.
15	1 in 1100	4 9
5½	550	11 7
33	330	16 0

It is well known to all those who have attended to the progress of Railways in this country, that the question as to what description of gradient is best adapted for the transit on Railways, has excited the most anxious interest in the scientific world and amongst Engineers.

Accordingly we find that the Committee of the House of Lords on the Great Western Railway Bill, has received important evidence from various Engineers upon this amongst other topics which engaged their attention.

From the evidence adduced before this Committee, the following extracts are taken.

It is unnecessary to comment upon these extracts, which contain the recorded opinions of some of the most eminent Engineers in this country, and their opinions are of so recent a date that they must be supposed to express the result of their matured judgment and experience up to the present time.

Mr. George Stephenson in evidence on the Great Western Railway Bill. July 1st, 1835.

Question. With the exception of the Box Tunnel, you know of no Railroad of such an extent with such advantageous levels?

Answer. I do not.

Question. With reference to the inclination of the Box Tunnel, in your judgment, is it advisable to select a point where, by making a steeper inclination upon a short line, you can regulate the rest of the levels upon the line advantageously?

Answer. It is always the plan I have adopted in all the works I have been concerned in.

Question. Was that the reason you adopted the short plane on the Liverpool of a mile and a half, where you have one in ninety-six on the one side, and one in ninety-eight on the other?

Answer. It is about ninety on the other.

Question. Did you select those inclinations in preference to spreading it over a larger surface of your Railway?

Answer. I did.

State your reasons for doing it.

Answer. To allow the engines to bring the heaviest loads possible to the bottom of the inclined plane, by having an assistant engine to get up the load; but if I had distributed that inclination over a longer length, the engine could not have got up that long incline, and it is too long to have an assistant engine.

Mr. George Stephenson. July 2nd, 1835.

Question. Is not the expense of the repair of the engines very much in proportion to the gradients upon the line?

Answer. It is.

Question. And the difficulties they have to overcome?

Answer. Yes.

Question. And therefore you think it better to have a steeper rise at one place, to be worked by a supplementary engine, or a fixed engine, than to give worse gradients throughout the line?

Answer. That is my opinion.

Mr. Vignoles in evidence on the Great Western Railway Bill. July 13th, 1835.

Question. Is 1 in 107 a very bad plane?

Answer. No; it appears scarcely a rise to the eye of a common observer; it is a plane that requires great additional power, and it is better to concentrate the power in

one spot than expend it upon long inclinations over a greater space of ground.

Question. Do you prefer that course of concentrating the inclination?

Answer. Most undoubtedly; it is far better to keep the line as flat as possible for a great length of time, and concentrate your power by having a stationary engine, or an assistant engine to overcome it.

Copy of a Report by Messrs. Stephenson and Palmer.

"To the Directors of the Great Western Railway Company:

"Gentlemen,—In reply to your inquiry relative to our investigation of the proposed line of Railway between London and Bristol, in which you particularly refer to the practical construction of the work, and the working of it by locomotive engines when completed, and whether Mr. Brunel had taken our opinion before he made the selection between the two inclinations at Box; we beg to state that we have examined the whole of the important parts of the proposed line, and consider it judiciously selected, not only as regards the execution, but also the working of the line when executed: and that Mr. Brunel did take our opinions upon the two planes at Box.

"Our advice to him was that he should select the shorter and steeper, as by concentrating the rise in one point, with a practicable length for working either by stationary or assistant locomotive engines, he reduced all the remaining inclinations upon the line to the present favorable amount. And we beg in addition to this to state, that many lines with planes of similar or greater length have been executed, and are now working efficiently, and that no difficulties in the execution of the work can be anticipated.

"The levels of your proposed line are undoubtedly superior to those of the Southampton, or the Basing and Bath, or of any other extensive line with which we are acquainted, and are therefore better adapted to the working of the locomotive engines, both as regards economy and expedition.

"We are, gentlemen,

"Your obedient servants,

"George Stephenson,

"Henry R. Palmer.

"London, March 31st, 1835."

Mr. R. Stephenson in evidence on the Great Western Railway Bill. July 8th, 1835.

Question. Is there more than one way of working a Stationary Engine?

Answer. Yes.

Question. Are those different methods attended with difficulty?

Answer. No; I have seen them all act very efficiently.

Question. I do not know whether you remember the alternative suggested, instead of that Box Tunnel, with a rise of 1 in 107 for two miles and a half?

Answer. Yes.

Question. It was 1 in 333 for nine miles?

Answer. About that.

Question. Which do you prefer?

Answer. I prefer the concentration of the inclination.

Question. What do you gain by the concentration of the inclination?

Answer. You apply a fixed Engine to that to which it is more applicable, and it is more economical upon that inclination; and you make the remainder of the distance extremely favorable for the operation of Locomotive Engines.

Question. What do you gain by it in point of power?

Answer. Very great economy of power, and you save a great deal of wear and tear in the Railway.

Question. Where the proportion of that inclination is two miles and a half, and the rest of the line such as you have described it, do you gain in point of speed also?

Answer. Yes; but the principal saving is economy.

Mr. R. Stephenson in evidence on the Great Western Railway Bill. July 10th, 1835.

Question. Have you any knowledge of the Tunnel at Box Hill, except what you have derived from Mr. Brunel?

Answer. As to the cost of making the Tunnel I cannot give an opinion.

Question. Do you know any thing of the country at that spot, so as to judge of the expediency of making a tunnel or not?

Answer. No; I treat it as an abstract question.

Question. Tell me the *data* upon which you proceed?

Answer. In preference to an inclination of six or eight miles at sixteen feet in a mile, I prefer a Tunnel; but I would not make a Tunnel in other cases to avoid an inclination; it is made here to enable the common engine to accomplish the journey upon the rest of the line.

Mr. H. H. Price in evidence on the Great Western Railway Bill. July 7th, 1835.

Question. With reference to the Box Tunnel, do you approve of the method we have heard so much of, namely, the con-

centration of the steepest inclination upon one spot?

Answer. Yes; I stated that opinion to Mr. Brunel when I first met him at Stroud, after the plans were deposited.

Question. That is not an opinion you have taken up lately?

Answer. No.

Question. What is the advantage gained by that concentration?

Answer. That you may apply assistant power to overcome the elevation of the country at one point, instead of spreading it over a greater space of the line.

Question. What is the result if you do not apply assistant power?

Answer. They carry lighter loads, or they go at a smaller speed.

Question. Or—is there not another alternative?

Answer. You may have a fixed engine.

Dr. Lardner in evidence on the Great Western Railway Bill. August 6th, 1835.

The artifice used in forming the Great Western Line (and a very good one it is) consists in concentrating the greatest rise in both directions upon one spot, and by that means obtaining a more uniform level, and so far as that goes it is a great advantage.

Mr. R. Stephenson in evidence on the Southampton Railway Bill. June 25th, 1834.

Question. Is it an object also to get the best levels that can be got?

Answer. Of course it is.

Question. If the level in such a Railroad as this, is such, that there are fifteen miles in going up to the summit of 1 in 300, would you consider that as an inconvenient rise, if you could avoid it?

Answer. If I could avoid it, certainly.

Question. Would you prefer lessening the inclination, and having a short part where the inclination should be so much greater as to require the assistance of an Engine.

Answer. I think I would prefer a short piece.

Question. Upon the Liverpool and Manchester you have two inclinations of one in eighty-six and one in ninety-six?

Answer. Yes.

Question. Was that mode of construction adopted with a view of enabling the engines to act with all their full power up to the rest of the line, and to have the assistance of stationary engines at that point?

Answer. That was the object.

Question. I believe you consider that an inclination of 1 in 240 diminishes half the power?

Answer. Yes, thereabouts: it has been taken at 300, but I think 1 in 240 is more correct.

Question. Should you consider it desirable to construct a line of Railroad with fifteen miles with an inclination of 1 in 300, or should you prefer a shorter length of a steeper inclination?

Answer. I should prefer the short inclination, if the other levels that were obtained by that means were good levels.

Question. If by making a steep inclination for a short distance of two or three miles, you could lessen the inclinations upon the general line, so as to enable the locomotives to carry a weight nearly to the extent of their power, you would consider that a preferable mode?

Answer. Yes, I would; it is impossible to give a general answer to that question; I should be guided by the circumstances of the case.

Question. Supposing you could form a line in which you might go with an inclination, where instead of diminishing the power of the engines one half, it was not diminished one quarter, but when they arrive at a particular point, they might require the assistance of another engine, because it diminished the power two-thirds, would you prefer the line upon which the diminution of the power of two-thirds was only for a short distance, and where the rest of the line gave three-fourths of the power?

Answer. I think I would.

Question. (By a Lord)—Might not there be other circumstances which would render the other line the best?

Answer. I merely speak as an Engineer generally upon the subject. I cannot at all speak as to any local difficulties that may arise; speaking as an Engineer, I would prefer a long line, upon which an engine could operate to its full power with a short inclination when an assistant engine was wanted.

☞ It is with real pleasure that we lay before our readers the following statement in relation to a gentleman, a *practical* mechanic, whose merits are, nevertheless, duly appreciated by the learned gentlemen who preside over one of our most respectable and flourishing Colleges.

To confer, in this instance, is as truly honorable as to receive; and it is an evidence—of which we hope to see many similar instances—that *true merit*, even when found in the work-shop, will find its proper station amongst intelligent and virtuous men.

It is, indeed, a misfortune that there have been so few instances in which laboring men, although possessing talent of the first order, have had the opportunity in early life to acquire the necessary taste for study and learning; and the firmness in middle age, when the cares and perplexity of business engross their attention, to devote their leisure moments to such reading as will naturally lead them to merit such a mark of distinction, from such an institution, as that recorded in the following paragraph from the Albany Evening Journal. It is not that laboring men, or mechanics, are naturally less talented than men of wealth; nor would they be, as a body of men, less competent than men of wealth, to acquire similar marks of distinction, if they possessed in childhood and youth, the opportunity of acquiring a taste and habit for study.

It will hardly be asserted, we imagine, that a greater number in *proportion*, of the wealthy than of the poor, would become learned and wise, if all enjoyed similar advantages. It is a truth, which requires no proof, that the man, who, from the humble and obscure walks of life, becomes distinguished for learning, virtue, and moral worth, gives evidence of more talent, and more merit, and is entitled to greater respect, than a man enjoying all the advantages of early instruction, and intelligent *society*, which is afforded in *almost* all cases by the possession of wealth. It will not, therefore, we apprehend, be denied, that the gentleman, who is the object of this, not only honorary, but *honorable*, A. M., who has probably earned it by a *constant*, and judicious devotion of those hours of *leisure* to reading and intense study, (which, by many of the journeymen and apprentices of *his*, as well as most other trades, and laborious callings, are *too* often spent in idleness, vice, or *dissipation*,) is entitled to great praise and commendation; nor that his example is worthy of universal adoption by young men.

It could only be by this, above all praise, honorable mode of spending his hours of relaxation from labor, that constant and unremitting daily labor to which every man, who has a family to support, without a fortune, must submit, that he could have qualified himself to merit, and if a *modest* man, to receive such a notice from such an Institution.

The Evening Journal says:—

"At the late Union College commencement, the Honorary degree of A. M. was conferred upon JOHN PATTERSON, of this city, a JOURNEYMAN PRINTER, whose mathematical attainments richly entitled him to that distinction. Mr. PATTERSON, who served his apprenticeship at Buffalo, came to this city some twelve years ago, where he has sinced worked, and is still working as a journeyman. He is now one of the best practical printers in the Union. By devoting those hours which most of us idle away, to severe study, Mr. PATTERSON has not only stored his mind with useful general information, but acquired a knowledge of Mathematics which has won for him a Degree from one of the most reputable Colleges in the Union. In addition to all this, with a family to support from his earnings, Mr. PATTERSON has garnered up about $3000, the fruits of patient toil and economy.—Such an instance of industry and frugality, combined with high intellectual aspirations, is worthy of the palmy days of RITTENHOUSE and FRANKLIN."

In addition to the above, we find in the Buffalo Journal, the following highly honorable compliment, which establishes beyond question, the real worth and sterling merits of this gentleman.

Few men, very few indeed, who establish whilst *apprentices* such a character, and carry with them into after life the affection of their teachers and masters, fail to become, not only respectable, but honorable members of society.

The Editor of the Buffalo Journal says:

"We copy from the Albany Evening Journal the preceding extract, with the simple remark, that Mr. Patterson, the recipient of the College honor, was an apprentice to the proprietor of this paper, and one of the most industrious and praiseworthy young men we ever knew. At his advancement, both in wealth and honors, none more heartily rejoice than ourselves."

Who would not prefer *such* an enviable distinction, to that of being, what so many, at this day, called *honorable* men, strive to be, *leading* and *prominent politicians*? Who, we ask, would not rather be *thus* complimented by those who best know their worth;

and by honest industry merit such a mark of distinction from such an Institution, than to see "HON." attached to his name, in consequence of being selected—by whom?—not by the mass of intelligence in the community; but, in *most* cases, by a *few* men who, at least *expect*, if they have not been *promised*, some *office* or *station* of honor, or profit, for their *dis*interested services in thus making him an *honorable* man? Reader, are we not right when we say, that there is more real merit in being an HONEST, than, when *thus* acquired, in being an *honorable* man?

Who, permit me now to ask, that devotes his early life to habits of industry and study; who that acquires habits of reading, of deep thought, and of serious reflection when young; and devotes his leisure hours, in middle life, in a proper manner, may not look forward with confidence, nay, with almost certainty, to similar marks of distinction, and to equal respect? No youth, however, need anticipate such a result, who is not attentive to the wishes of his employer; honest, industrious, virtuous, and studious; but with these traits of character and ordinary prosperity, every one may obtain them.

Permit me, then, young men, to urge you *onward* in habits of industry and economy; and studious devotion of your leisure hours to books—books of real utility and not of fancy—then may you, in after life, also be honored with an A. M.

The following excellent article in relation to "Apprentices' Libraries," and the manner in which *apprentices* ought to spend their leisure time, is from the Buffalo Commercial Advertiser. It contains advice which, if duly appreciated, will be the means of making many a wise, happy, and affluent mechanic, in that "City of the Lakes," which but a few, say *twenty* years since, had *scarcely a mechanic to boast of*; whilst it now numbers its — thousand inhabitants, and will soon vie with many of the Atlantic cities.

APPRENTICES' LIBRARY. — As the long winter evenings are approaching, when time and business afford an opportunity for improvement in the intellectual resources of the numerous apprentices of our city, we would call their attention to the Society which has been established for their especial benefit. By the liberality of our citizens, a respectable library has been collected, which, were its benefits properly appreciated, would effect a great change in the moral and intellectual condition of many apprentices who are wasting their time in worse than useless amusements, which have a tendency to vitiate their habits and ruin their characters. Let them but employ the moments now dissipated in illeness, in the reading and discussion of works of a practical character, and they would acquire a fund of useful information, which, in after life, would be of incalculable worth in all their relations with the world. Youth is the time — the only time — which may be properly set apart for this object; and if it be squandered with impunity, in future years, lasting regret will come over the improvident, and they will in vain recall to their minds the many opportunities lost, which might have advanced their happiness and their respectability among their fellow men. In a city like ours, a thousand attractions present themselves to the young, and if they give way to the indulgence of their curiosity in one point, they may in another, until wholly absorbed in the gratification of present propensities, without once thinking of the future, or the results which flow from an early compliance with their own inclinations or the entreaties of others. Let them adopt the principle of *total abstinence* from all *useless* amusements, and only indulge in those from which some practical good will result, and a mighty change would be wrought among them, which would be felt throughout the mechanical portion of community.

THE ART OF PRINTING.—The folllowing article, in relation to the discovery and progress of the art of printing, cannot but be interesting to most of our readers.

According to it, it is 405 years since the art of printing was first discovered—the progress of the art was, however, almost imperceptible for nearly a century—and even until within the last fifty years its progress was very gradual.

At the present time, however, it would seem to be making rapid strides. *Ten years* ago, 24 to 2,800 pages per hour, of this Magazine, would have been a great day's work for a man and boy—whereas, with the present facilities and improvements, we can

now print, with one man and *two* boys, 24 to 32 *thousand* pages in the same time, with much less labor and fatigue.

We shall, at an early period, give a more minute description of the improvements by which this wonderful performance is effected. At present we will merely observe, that it is done on a registring machine, which prints *both* sides of the sheet before it leaves the press, and which is driven by a *Rotary Steam Engine*, which makes more than *five thousand revolutions per minute!*

THE ART OF PRINTING.—On the tenth and eleventh days of July, it is customary at Haarlem, occasionally to celebrate a festival in commemoration of the invention of typographical printing: alledged to have been made by John Lawrens Koster of that place in the year 1430. Although it is certain that the Chinese and Japanese, about a thousand years before the Christian era, understood and practised the art of printing from carved wooden tables, (called technically xylograhic printing,) yet it is equally certain that the Europeans had no knowledge of the existence of this art among the Chinese and Japanese until the beginning of the sixteenth century. It was not until about the year 1498, that Vasco de Gama discovered the route to the East Indies by sea; and it was from the navigators who succeeded him, that the first correct ideas of the state of the arts in China were obtained.

The honor of having given birth to typographical printing, or printing with *moveable* types, is claimed by three cities, Haarlem, Strasburgh and Mentz. It is perhaps not very material to decide between them. The Dutch consider the question proved beyond dispute in favor of Koster. Many of Koster's impressions have been discovered, and are now to be seen: and Scheltema and Konings, have, it is thought, shown conclusively, as late as 1823, that these impressions were made with *moveable types.*

It is now 405 years since Koster's genius produced this useful art. What wonders has it not already accomplished, and does it not promise to accomplish! The press has been called, and not inaptly, "the lever which moves the world." What revolutions in the political and moral world have not been effected by it! With it is intimately connected, and to it do the free of all nations, in a greater or less degree, owe the liberties and privileges they enjoy. The rich legacy left by John Lawrens Koster has descended not only to the Hollanders, but to the inhabitants of the whole civilized world! civilized, did we say; nay, even the uncivilized nations of the earth are beginning to reap its benefits.

We copy the following remarks from a little work on the fine and useful arts, lately published by M. S. Perry, M. D. We think they will prove interesting to those of our readers who are not acquainted with the facts here detailed. "Koster, called also Lawrentius, went to walk in a wood near the city, as was the custom of the opulent class; once, when there, he began to cut some letters upon the rind of a beach tree, which for fancy's sake he afterwards set and arranged in order, and put the words upon paper with their *heels* up, and so impressed and printed on paper one or two copies, as specimens for his grandchildren to follow in writing. This having happily succeeded, he meditated greater things, as he was a man of ingenuity and judgment; and, first of all, he invented, with his son-in-law Thomas Pieter, a more glutinous ink, because he found the common ink would sink and spread. And then he formed whole pages of wood, with letters cut upon them. Laurentius was a man of fortune, and held a lucrative office under government. He commenced printing with wooden blocks or plates, on which he engraved or carved the words for several small volumes. He employed several workmen, among whom were John Geinsfleiche. Geinsfleiche communicated the art to his younger brother, named Gutenberg, an ingenious mechanic, who lived at Strasburgh. After having stolen a part of his master's apparatus, Geinsfleiche went to Mentz, his native place, and commenced printing about the year 1440. He was assisted with money at first by John Fust, Faust,or Faustus; and afterwards he entered into partnership with him and his brother Gutenberg.

The two brothers united their endeavors to invent a font of metal types with cut faces; they succeeded after many years, and in 1450 a part of the Bible appeared from their press. The partnership between the brothers and Faust was dissolved in 1455. Faust continued the business, and took one of his servants, Peter Schoeffer, into partnership. In 1556, Schoeffer completed the invention of metallic types by casting them with faces; he likewise cut matrices for the whole alphabet, with which Faust was so much pleased that he gave him his only daughter in marriage.

The story of the Devil and Dr. Faustus originated from the following circumstance. Faust had printed a beautiful edition of the Bible, which was an exact imitation of the best manuscript. He took a number and went to Paris, where he at first sold them for six and then for five hundred crowns each. At last he lowered his price to thirty crowns each, and all Paris was perplexed at the number of copies produced, and their exact uniformity. They accordingly believed

that Faust had made a league with the Devil, and he was accused of being a magician.

A knowledge of the art was soon obtained in Rome, and the Roman type was introduced in 1467.

In the reign of Henry the Sixth, R. Tourneur and William Caxton went to Haarlem to learn the art. These gentlemen persuaded Corsellis, an under workman, to go to England, and a press was set up at Oxford in the year 1471. The first book printed in the English language was the History of Troy, translated from the French by William Caxton. Ireland was one of the last European countries into which the art of printing was introduced; the first work executed there was in 1551. Printing was practised in Mexico about the year 1569.—The first printing press in the United States was established by Stephen Daye, at Cambridge, in 1639; William Bradford commenced printing in Philadelphia in 1687."

Mechanical Lectures.—It is of vast importance to the rising generation of mechanics that they should enjoy the advantages of Mechanical and Scientific Lectures. One of the objects of this work has been, and is, to contribute to the instruction of those young men, who, like its publisher and editor, commenced their career as an *apprentice*, and rely upon their own hands for success in life; and therefore we take a deep interest in the extension of such advantages to young mechanics generally, as will enable them to become intelligent, virtuous, and worthy members of society, and an honor to the mechanics of our country.

Entertaining these views, and feeling it to be the duty of every community to encourage, and aid, the young men amongst them who desire instruction, we were surprised to see a notice in the New-Jersey Freeman, published at Elizabethtown, N. J., of which the following is an extract:

"The Committee of the Young Men's Mechanic Philosophical Class give notice to its members that the Lecture expected on Tuesday evening will not be delivered.—They regret to be compelled also to inform the class, that a suspension of the Rev. J. T. Halsey's course of Lectures is rendered necessary, because of their inability to procure a convenient room sufficiently large to accommodate all who wish to attend. The room in which the meeting of the class have heretofore been holden will not contain more than a third part of the young mechanics desirous of attending this course, and an application for the only suitable room in the town has been unsuccessful. The Committee would take this opportunity of publicly expressing their thanks for the generous offer of the Lecture Room belonging to the Second Pres. Church, which, however, on account of many objections to the occupation of that place for such a purpose, they thought it adviseable to decline. They, nevertheless, confidently indulge the hope, that the liberality of an enlightened public and particularly of those gentlemen who feel a lively concern for the improvement and welfare of the young men of Elizabethtown, will not suffer the "Young Men's M. P. Class," comprising over a hundred of the young mechanics of the town, to be deprived of the benefit of the course of Lectures which Mr. Halsey has kindly offered to give gratuitously, for the want of a proper and a comfortable place in which to assemble.

Fenwick T. Williams,
Moses H. Ogden,
William S. Thompson,
Mahlon Mulford,
Committee."

We indulge the hope that these young men will not be deprived of the benefit of the liberal offer of the Rev. Gentleman; and that the citizens of Elizabethtown will speedily provide a suitable, and convenient, room for their accommodation.

We would also say a word to the young gentlemen in whose behalf we have written these remarks—yet, as nothing of our own could be more to the purpose, we recommend to their especial notice the maxims which we publish in another part of this number, more especially the three first.

The Cretan Sarcophagus.—A magnificent sarcophagus was discovered last year in Crete, by Sir Pulteney Malcolm, who patriotically brought it to England, we hear, to present it to the University of Cambridge. It is of Parian marble, and more than seven feet long, and in fine preservation. It was found in a small plain, near a village called Ayo Vasile, seven or eight miles from Viano, and though broken into many pieces, the whole has been ingeniously united under the direction of Chantrey, in whose studio it may be seen by all who are curious in antique sculpture. The ends, as well as front of the sarcophagus, including the cover or lid, are entirely sculptured. The subject is the triumphant return of Bac-

chus from India; and though it seems to have little connection with death and the grave, it must be borne in mind, that the god was born in the isle, and that the Cretans invented the orgies in his honor. The figures are in high relief: a naked youth, stooping under a wine skin, accompanied by a musician, leads the procession; an elephant follows, with three girls on its back, playing on the double pipe and cymbals; Silenus, sufficiently intoxicated, is borne after by two youths, who seem not unconscious of the weight, while a satyr follows, striking a tambourine, and actually leaping into the air with delight. A male and female centaur succeed; 'one seems woman to the waist, and fair, but ending foul,' the other has his brows bound in vine leaves, and seems in a passion, which his female companion tries to soothe, by throwing her arm round his neck; an empty cup, depending from her fingers, intimating that wine has something to do with the wrath which agitates him; this is more distinctly intimated by the action of the closing group. Bacchus appears—all youth and beauty—grave rather than joyous—in a splendid car, on a panel of which a youth and satyr are contending; the right hand of the god elevates a trophy, while the left hand protects a trembling fawn, his companion in the car, at whom the angry centaur seems in the act of throwing a wine cup. The fear of the one, and the surly wrath of the other, are well expressed. Two men on one end of the sarcophagus seem disputing about a child, which they are bearing away in a basket; while on the other end two cupids are engaged in an attempt to put a tipsy satyr to bed; drapery is suspended between two trees; the urchins have their friend on their shoulders, and are striving, on tiptoe, to heave him up, while a quiet smile is playing over the brows and in the corners of his mouth, at their fruitless endeavors. All this seems more akin to luxurious painting than to the simplicity and gravity of sculpture. The relief wrought on the lid, is of a still more joyous character.—[Scientific Tracts.]

ELECTRICITY.

Dr. Smith—Dear Sir,—You have my grateful acknowledgments for an interesting number of your Scientific Tracts. I regret to learn that you were disappointed in the trial of some experiments which I communicated to you concerning the motion of camphor on the surface of liquids. I have repeated them several times with the same results.

Will you accept a few observations from my journal (of 1830) on the subject of Electricity.

Penetrability of Electric Light.

If a piece of sugar, a potato, or an egg, be included in the circuit of a Leyden jar, whenever a discharge takes place, a beautiful illumination is produced. A decanter of water, or the finger, may be strongly illuminated by the light from a battery or large jar. But by far the most brilliant illumination which I have ever seen from the electric light, may be produced by passing simply the spark from the prime conductor through the dried pith of corn-stalk. A sound piece of corn-stalk should be selected, the pith carefully cut out and thoroughly dried, and it is fit for use. The length of the piece of pith should be the same as that of a spark taken from the ball of the conductor. Whenever a spark is passed through the pith, a perfect, intense yellow light pervades its whole substance. Frequently red and yellow lights are produced together, and sometimes violet. This experiment will richly repay any operator for his trouble. It must be recollected, that unless the pith be thoroughly dried, the illumination will not be produced, as the electricity will pass by conduction.

Electrical Property of Copal.

I have frequently observed, while polishing pieces of copal, containing insects, that it became strongly electrical, and have been induced by this to make further trial of its value as an electric. The best form of this substance for experiment I found to be the dried copal varnish. On varnishing a large glass rod, and rubbing it with a piece of amalgamated silk, the quantity of electricity developed was immense, far exceeding that produced by the uuvarnished glass. I then varnished the cylinder of my electrical machine, and the result surpassed my expectations. The machine furnished

treble its usual quantity of electricity, and this continued for some months, when it began to abate its action. I found the varnish had become scratched by the crystallized portions of amalgam, and was obliged to scrape the varnish entirely from the cylinder. It remains, then, for some one to point out a method by which the friction of the rubber and cylinder may be diminished, with the pressure remaining the same, to make this improvement complete.*

If you think these facts are worthy of a place in your Tracts, you may embody them in whatever form you please.

Yours truly,

CHARLES G. PAGE.

Salem, September 26, 1835.

METHOD OF WORKING HORN.

Horn, particularly of oxen, cows, goats, and sheep, is a substance soft, tough, semitransparent, and susceptible of being cut and pressed into a variety of forms; it is this property that distinguishes it from bone. Turtle or tortoise shell seems to be of a nature similar to horn, but, instead of an uniform color, it is variegated with spots. These valuable properties being known, render horn susceptible of being employed in a variety of works fit for the turner, comb and snuff-box maker. The means of softening the horn need not be described, as it is well known to be by warmth; but an account of the cutting, polishing, and soldering it, so as to make plates of large dimensions, suitable to form a variety of articles, may be desirable. The kind of horn most to be preferred is that of goats and sheep, from its being whiter and more transparent than the horn of any other animals. When horn is wanted in sheets or plates, it must be steeped in water, to be able to separate the pith from the kernel, for about fifteen days in summer, and a month in winter; and when it is soaked, it must be taken out by one end, and well shook and rubbed, in order to get off the pith, after which it must be put for half an hour into boiling water, and then taken out and the surface sawed even lengthways. It must again be put into the boiling water to soften it, so as to render it capable of separating; then, with the help of a small chisel, it can be divided into sheets or leaves. The thick pieces will form three leaves; those which are thin will form only two, while young horn, which is only one quarter of an inch thick, will form only one. These plates or leaves must again be put into the boiling water, and when they are sufficently soft, they must be well worked with a sharp cutting instrument, to render those parts that are thick, even and uniform. It must be put once more into the boiling water, and then carried to the press.

At the bottom of the press employed there must be a strong block, in which is formed a cavity of nine inches square, and of a proportionate depth; the sheets of horn are to be laid within this cavity in the following manner, at the bottom: —First a sheet of hot iron, upon this a sheet of horn, then again a sheet of hot iron, and so on, taking care to place at the top a plate of iron, even with the last; and the press must then be screwed down tight.

There is a more expeditious process, at least in part, for reducing the horn into sheets, when it is wanted very even. After having sawed it with a very fine and sharp saw, the pieces must be put into a copper used for the purpose, and there boiled until sufficiently soft, so as to be able to split with pincers: then bring quickly the sheets of horn to the press, where they are to be placed in a strong vice, the chaps of which are of iron, and larger than the sheets of horn, and screw the vice as quick and tight as possible; let it then cool in the press or vice; or it is as well to plunge the whole into cold water. The last mode is preferable, because the horn does not dry up in cooling. Now draw out the leaves of horn, and introduce other horn to undergo the same process. The horn so enlarged in pressing is to be submitted to the action of the saw, which ought to be set in an iron frame if the horn is wanted to be cut with advantage, in sheets of any desired thickness, which cannot be done without adopting this mode. The thin sheets thus produced must be kept constantly very warm, between plates of hot iron, to preserve their softness. Every leaf must be loaded with a weight heavy enough to prevent its warping. To join the edges

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* The varnish should be very hard and dry before it is used.

of these pieces of horn together, it is necessary to provide strong iron moulds suited to the shape of the article wanted, and to place the pieces in contact with copper plates, or with polished metal surfaces against them; when this is done, the whole is to be put into a vice and screwed up tight, then plunged into boiling water, and after some time, it is to be removed from thence, and immersed in cold water, which will cause the edges of the horn to cement together, and become perfectly united.

To complete the polish of the horn, the surface must be rubbed with the subnitrate of bismuth by the palm of the hand. The process is short, and has this advantage, that it makes the horn dry promptly.

When it is wished to spot the horn in imitation of tortoise shell, metallic solution must be employed, as follows:—To spot it red, a solution of gold in aqua regia must be employed; to spot it black, a solution of silver in nitric acid must be used; and for brown, a hot solution of mercury in the nitric acid. The right side of the horn must be impregnated with these solutions, and they will assume the colors intended. The brown spots can be produced on the horn by means of a paste made of red lead, with a solution of potash, which must be put in pieces on the horn, and subjected some time to the action of heat. The deepness of the brown shades depends upon the quantity of potash used in the paste, and the length of time the mixture lays on the horn. A decoction of Brazil wood, a solution of indigo, with sulphuric acid, a decoction of saffron, and Barbary tree wood, is sometimes used. After having employed these materials, the horn may be left for half a day in a strong solution of vinegar and alum.

In France, Holland, and Austria, the comb-makers and horn-turners use the clippings of horn, which are of a whitish yellow, and tortoise shell skins, out of which they make snuff-boxes, powder-horns, and many curious and handsome things. They first soften the horn and shell in boiling water, so as to be able to submit them to the press in iron moulds, and by the means of heat, form it into one mass. The degree of heat necessary to join the horn clippings must be stronger than that for shell skins, and which can only be attained by experience: the heat must not be too great, for fear of scorching the horn or shell. Considerable care is required in these operations not to touch the horn with the fingers, nor with any greasy body, because the grease will prevent its joining perfectly. Wooden instruments should be used to move them while they are at the fire, and for carrying them to the moulds. —[Scientific Tracts.]

THE CITY OF DORT, IN HOLLAND, PRESERVED BY MILKMAIDS.—During the wars in the Low Countries, the Spaniards intended to besiege the City of Dort, in Holland, and accordingly planted some thousands of soldiers in ambush, to be ready for the attack when opportunity might offer. On the confines of the city lived a rich farmer, who kept a number of cows in his grounds, to furnish the city with butter and milk. His milkmaids, at this time, coming to milk their cows, saw under the hedges the soldiers lying in ambush, but seemed to take no notice; and having milked their cows, went away singing merrily. On coming to their master's house, they told him what they had seen; who, astonished at the relation, took one of the maids with him to a burgomaster at Dort, who immediately sent a spy to ascertain the truth of the story. Finding the report correct, he began to prepare for safety, and instantly sent to the States, who ordered soldiers into the city, and commanded the river to be let in by a certain sluice, which would instantly lay that part of the country under water where the besiegers lay in ambush. This was forthwith done, and a great number of the Spaniards were drowned; the rest, being disappointed in their design, escaped, and the town was thus providentially saved. The States, to commemorate the memory of the merry milkmaids' good service to the country, ordered the farmer a large revenue as a recompense to him for the loss of his house, land, and cattle; and caused the coin of the city to have a milkmaid, milking a cow, to be engraven thereon, which is to be seen at this day upon the Dort dollars, stivers, and doights; and similar figures were also set up on the watergate of Dort: and the milkmaid was allowed for her own life, and her heirs for ever, a very handsome annuity.—[Edinburgh Quarterly Journal of Agriculture.]

MANNER OF MAKING PERSONS FREE AT ALNWICK, IN NORTHUMBERLAND. — Those who are to be made free, or, as the phrase

PAGINATION INCORRECT

is, *leap the well*, assemble in the market-place, very early in the morning, on the 25th of April, being St. Mark's day. They appear on horseback, dressed in white, with white nightcaps, and every man a sword by his side, attended by the four chamberlains, and the castle-bailiff, mounted and armed in the same manner. They then proceed, with music playing before them, to a large dirty pool, called Freeman's-Well, where they dismount, draw up in a body, then rush in all at once, and scramble through the mud as well as they can. After this they take a dram, put on dry clothes, remount their horses, gallop round the confines of the district, and then re-enter the town, sword in hand, and are met by women, dressed in ribands, with bells and garlands, dancing and singing. These are called Timber-wastes. On this day, the houses of the new freemen are distinguished by a holly-bush, as a signal for their friends to come and make merry with them on their return. This manner of making free is peculiar to Alnwick, according to a clause in the charter given them by King John, who, travelling this way, stuck fast in a hole, and thus punished the town, for neglecting to mend the roads.—[Ib.]

A BRIEF ADDRESS TO YOUNG MEN.

The following breif address to the young men of our country is taken from the first or specimen number of the Cultivator. It is worthy of a repeated perusal by every young man, and deserves to be universally practised upon.

"The YOUNG MEN we would specially appeal to. You are destined soon to occupy the stage of public action, and to fill the important stations in society. *Now* is the time to *prepare* for those high duties, as well as for profit and distinction in your business. Your characters are but partially formed, and are yet susceptible of receiving good or bad impressions, which are to last through life. It is important to you, to your friends, and to society, that these impressions should be for good. We will lay before you rules and examples of the wisest and best men, to aid you in the formation of your characters—to enable you to become intelligent and successful in your business,—useful and respectable in society,—and beloved and happy in your families. Do not object that you have no *time* to read. Few young men labor more hours than did Benjamin Franklin, or are more humble and self-dependent than he was in his youth; and yet Franklin found abundant time for self-instruction; and so indefatigable and successful was he in his studies, that he became one of the most useful and celebrated men of the age. We need not limit the remark to Franklin. Most of the distinguished men of the day have risen from humble stations by their own industry and frugality, and have acquired a great share of their knowledge in the hours not allotted to ordinary business. Your winter evenings are your own, and may be applied usefully. They may be computed at one-fourth of the day, or one entire month in the year. Time is money: and the young man who appropriates this month to the acquiring useful knowledge, does more to add to his future fortune, to say nothing of his intellectual wealth, than if he received pay for this month and loaned it upon interest. Knowledge is in another respect like money: the greater stock of it on hand, the more it will administer to the respectability and enjoyments of life. But knowledge is not to be acquired without exertion, nor is any thing else that is useful in life. It is the labor we bestow in acquiring an object that imparts to it an intrinsic value. It has been well said that, 'although we may be learned by the help of others, we never can be wise but by our own wisdom.' It is the humble design of this monthly sheet to excite a laudable ambition to improve the mind as well as the soil. If we succeed in awakening the latent energies of the former, we think the latter will follow as a natural consequence, and our object will be attained."

We present to our readers, from the Cultivator, No. 2 of the "Letters from a Father to his Son"—and we earnestly recommend them to the notice of every *son* who desires to contribute to the happiness of his parents and friends, and at the same time to promote his own.—*Read and practice!*

EDUCATION.—There are few terms of more indefinite meaning than the one which heads this letter. Some suppose it consists in learning to read, write and cypher; while others contend, that no young man can be deemed educated, or at leat *well* educated, until he has been dubbed *A. M.* at a college, has passed a term at some academy, or has become a licentiate in one of the learned professions. My definition varies from both, and comprises more than either. I define education—*a knowledge of our religious, moral, political, social and relative duties,*—AND THE HABITUAL PERFORMANCE OF THEM. The apprentice, who has merely acquired the names of the tools which belong to a trade, may as well be deemed to have learnt that trade, as the boy to be educated, who has merely obtained school instruction.

The tools are the means by which the apprentice, by attention and industry, is to acquire a knowledge of the trade, and his reputation as a mechanic will depend upon the fidelity and skill with which he employs them. Schooling is to the mental what tools are to the physical powers.—the *means* of becoming useful to one's self, and to society at large;—and in both cases success and distinction are wisely made to depend upon individual exertion. The *boy* may acquire the mechanical art, but the noblest powers of the mind are seldom developed but in *manhood*. Thus you perceive that I consider your education as having but commenced; and that you have yet to learn, by study and reflection, those high duties of manhood which are to have an intimate bearing upon your future happiness and prosperity. Your mind has yet to be disciplined, by reading, observation and reflection, and your habits are yet to be fixed. Practice is as necessary in this as it is in mechanics—it is as necessary to make a fluent orator, or a graceful writer, as it is in cutting well a coat, or shoeing a horse. To stimulate you to the performance of duty, and to deter you from habits of sloth, indolence and vice, I here venture to assure you, as a conviction growing out of half a century's experience and observation,—that the practice of every virtue will bring its reward, in one shape or another—and that indulgence in vice, will as assuredly be followed by some corresponding suffering, in mind or body. We enjoy animalpropensities in common with the brute creation;—but the higher feelings—the moral sentiments,—the pleasures of intellect,—belong peculiarly to man—and man rises in the scale of beings in proportion as he cultivates and improves these peculiar gifts of his Creator.

[From the Cultivator.]

J. Buel, Esq.

Sir,—Permit me to present to your readers a translation of the story of Lucius Quinetius Cincinnatus. In order duly to appreciate the history of this man, whose name after the lapse of centuries has reached even this western world, it is necessary to be able to peruse it in the simple but inimitable language of the great Roman Historian. There is in the original description a beauty and simplicity which are unrivalled. When Rome was distracted by commotions within, and assailed by hostile bands without—when the army commanded by the consul was besieged even within their camp, and dared not go forth to meet the foe, — when all was confusion and dismay, and destruction seemed to threaten even the city itself, Lucius Quinetius Cincinnatus was appointed dictator by the unanimous voice of the people. The affairs, as recorded by Livy, is as follows:

"Let those listen to the story of Cincinnatus, who despise every thing when compared with riches, and who deem the poor neither virtuous or honorable. Lucius Quinetius, the only hope of the Roman empire in the hour of peril, cultivated four acres of land upon the banks of the Tiber. He was there found by the commissioners despatched for this purpose, while engaged in *ploughing*. Having exchanged salutations, they beseeched him for his own sake, and from his regard for the Republic, to listen to the commands of the Senate. Amazed, and anxiously inquiring "if all was well," he desires his wife Racilia to bring his gown from the cottage with all possible haste. No sooner had he wiped away the dust and sweat, and thrown around him his garments, than the ambassadors, with congratulation, salute him dictator, and invite him to the city, declaring that the army was overwhelmed with terror. In a ship prepared at the public expense, Quinetius and his three sons are conveyed to Rome: his relatives and friends, and all the nobles, go forth to meet him. Surrounded by an immense multitude, and attended by lictors, he is conducted to his future abode. Having met and overcome the enemy, and restored peace to the city, he resigned the office of dictator at the close of the sixteenth day, although elected for six months, choosing to cultivate his humble farm, and abide in his humble cottage, rather than control the destinies of the Roman people."

Let those who cultivate the soil with their own hands, reflect upon the following facts in the story of Cincinnatus. He was a humble farmer—possessed only *four acres* of land—dwelt in an humble *hut* or cottage — was found by the commissioners actually employed in labor — was covered with dust and sweat, the necessary accompaniments of rural toil; and yet even this man, by the unanimous voice of the people, was placed at the head of the Roman empire, with absolute power over the property and lives of his fellow citizens. Having accomplished the object for which he was elected, he most readily and cheerfully resigns his office, and retires to the shades of private life. The name of Cincinnatus will never die; while simplicity and virtue remain on earth, it will stand emblazoned in characters that "can be seen and read of all men."

Oneida.

Vernon, June 21, 1835.

The Mathematical Instinct of Bees.—The operations of pure instinct have never been supposed by any one to

result from reasoning; and certainly they do afford the most striking proofs of an intelligent cause, as well as of a unity of design, in the world. The work of bees is among the most remarkable of all facts in both these respects. The form is in every country the same—the proportions accurately alike—the size the very same, to the fraction of a line, go where you will; and the form is proved to be that which the most refined analysis has enabled mathematicians to discover as, of all others, the best adapted for the purposes of saving room, and work and materials. This discovery was only made about a century ago; nay, the instrument that enabled us to find it out—the *fluxional calculus*—was unknown half a century before that application of its powers. And yet the bee had been for thousands of years, in all countries, unerringly working according to this fixed rule, choosing the same exact angle of 120 degrees for the inclination of the sides of its little room, which every one had for ages known to be the best possible angle, but also choosing the same exact angles of 110 and 70 degrees for the inclinations of the roof, which no one had ever discovered till the 18th century, when Maclaurin solved that most curious problem of *maxima* and *minima*, the means of investigating which had not existed till the century before, when Newton invented the *calculus*, whereby such problems can now be easily worked. —[Lord Brougham's Discourse of Natural Theology.

[From the American Gardener's Magazine.]

The Influence of Flowers. By C. C.

"Are not flowers the stars of earth, and are not stars the flowers of Heaven? Flowers are the teachers of gentle thoughts, the promoters of kindly emotions."

Among the many indications of the advance of our country in taste and refinement, none afford a surer criterion than the increased attention which is given to flowers and fruit. When we notice the many establishments in our vicinity, within a few years, devoted to the improvement of horticulture, we cannot but rejoice at the diffusion of an employment so well adapted to afford much pure and innocent pleasure; and we doubt not the time will soon arrive, when the cultivation of flowers will be pursued as a means of moral and intellectual advancement, as well as a source of exquisite gratification.

Every thing which tends to increase domestic enjoyment, which furnishes to a family that pleasure at home, which otherwise they would be impelled to seek elsewhere, is valuable. There is nothing which adds more to happiness, than for all the members of a family to be united in one common and pleasant pursuit—not that all should have the same daily occupation—but that there should be some sources of pleasure open to all, and to increase which, all should in their turn contribute. No employment, perhaps, can so effectually give this union of purpose, and this sympathy of feeling, as the cultivation of flowers. It opens a wide prospect of enjoyment, with scenes to suit many varying tastes. To the scientific mind, to one who loves to search out causes and effects, to discover the hidden properties and qualities of things, what an interesting and yet almost untrodden field does botany present! Then to one whose heart predominates over the intellect; who delights in sentiment; who prefers deep feeling to lofty thought, a garden yields many exquisite delights. His poetic mind gathers much of its finest imagery, its most beautiful thoughts, from the fragrance and loveliness of flowers, and it is quickened and enlightened by the thoughtful contemplation of their varied graces.

And for humbler purposes, for less exalted natures, the riches of Flora furnish many gratifications. For the morning drawing-room, or for the evening dress, there can be no prettier or more appropriate ornaments than can be found among her stores. And to the affectionate heart, what sweeter tribute can be offered to the invalid mother, or the declining sister, than the first-fruits of the garden, and the first buds of the rose. Even the little child laughs, in the fulness of its happiness, when it is permitted to play with the flowers, and fill its lap with the butter cups and clover blossoms.

And so it is in this one amusement; all ages and all tempers can find an appropriate gratification; all may be made more happy. It ministers, also, to man's moral nature. A green-house, connected, as we sometimes see them, with the most frequented apartments of a family, is, in winter, when the garden is bereft of its beauty, and the orchard has yielded its fruit, an almost unfailing source of interest. To enjoy, when storms are beating without, and the chill of winter speaks in the howling wind, the mild air, the fragrance, and the beauty of this reserved fragment of summer, tends to produce feelings of contentment and satisfaction—feelings which show themselves forth in acts of kindness and words of affection.

Another advantage which the cultivation of flowers affords over other pleasures is, that it can hardly be wrested to evil. Absorbing as it is, it produces no feverish excitement. Bringing the mind into close contact with the loveliest things in nature, it shuts out the vexatious feelings arising from collision with the world. Its pleasures are all calm and tranquil. The contemplation of any of the works of God has a mighty effect in soothing and quieting the tumult of human passions, and this precious power over the heart is freely given, even to the lilies of the field. Where we see a love for these, that is not the place to look for the turbulence of passion, or the debasements of sensuality. When we see by the road-side a cottage, around whose door the sweet-briar and the honey-suckle are climbing, and before which, in its little garden, is displayed even the humbler flowers,—the marygold, the pansy, the aster, and the poppy—how instinctively do we form a favorable opinion of the inhabitants of that cottage; how certain we may be of finding peace, contentment, and affection, inmates here! C. C.

October, 1835.

The Tomato.—Dr. Bennett, the Professor of Midwifery, and the Diseases of Women and Children, Hygeine and Acclimatement, in the Medical College of Lake Erie, which is the Medical Department of the Wiloughby University of Lake Erie, at Chagrin, Cuyahoga Co., Ohio, in his public introductory lecture recently delivered in that flourishing institution, made the following statement relative to the *Solanum Lycopersicum*, or, as it is generally called, tomato, love apple, Jerusalem apple, &c., to wit:

1st. That it (the tomato) is one of the most powerful deobstruents of the Materia Medica, and that in all those affections of the liver, and other organs where calomel is indicated, it is probably the most effective and least harmful remedial agent known to the profession.

2d. That a chemical extract will probably soon be obtained from it which will altogether supercede the use of calomel in the cure of disease.

3d. That he has successfully treated serious diarrhœa with this article alone.

4th. That when used as an article of diet, it is almost a sovereign remedy for dyspepsia, or indigestion.

5th. That persons removing from the east, or north, to the west, or south, should by all means make use of it as an aliment, as it would in that event, save them from the danger attendant upon those violent bilious attacks to which almost all unacclimated persons are liable.

6th. That the citizens in general should make use of it, either raw, cooked, or in form of a catsup, with their daily food, as it is the most healthy article of the Materia Alimentaria, &c.

Now if these positions be true, it is of the utmost importance that the public should be made acquainted with the facts, and it is with this view that I now make this communication for the press.

The Farmer.—It does one's heart good to see a merry round-faced farmer. So independent, and yet so free from vanities and pride. So rich, and yet so industrious; so patient and persevering in his calling, and yet so kind, social and obliging. There are a thousand noble traits about him which light up his character. He is generally hospitable—eat and drink with him, and he won't set a mark on you, and sweat it out of you with double compound interest, as some I have known will: you are welcome. He will do you a kindness without expecting a turn by way of compensation: it is not so with every body. He is generally more honest and sincere—less disposed to deal in a low and underhand cunning, than many I could name. He gives to society its best support; is the firmest pillar that supports the edifice of Government; he is the lord of nature. Look at him in his homespun and gray back—gentlemen laugh if you will—but, believe me, he can laugh back if he pleases.

The American Journal of Science and Arts, conducted by Benj. Silliman, M. D. LL. D.—October. New-Haven, H. Maltby and Herrick & Noyes. New-York, G. & C. Carvill & Co.—This number is almost entirely given up to an account of the coal formation of the Ohio and its confluent rivers, by Dr. S. P. Hildreth, of Marietta, Ohio. The mass of information, of curious results, and magnificent realities, embodied in this paper, makes it one of great interest—even to unscientific readers. There are annexed to the account several pages of woodcuts, representing accurately the various fossil remains found in the coal beds, and occasionally portions of the striking scenery amid which these beds are stretched far and wide.

Personally, we read this paper with the more interest from having last Spring passed over a portion of the region described in it, and been struck with the prodigality of nature in her gifts to it. The annexed account will, we are sure, be new, as well as interesting to many of our readers.—[N. Y. Am.]

The Bituminous Coal Fields of Pennsylvania.—Nature, in the disposition of her bounties, seems to have bestowed upon Pennsylvania, more

than a due proportion of the treasures of the mineral kingdom. Great and valuable as are her anthracite deposits, and rich and abundant as are her mines of iron ore and other minerals, her bituminous coal region is still more extensive and inexhaustible. The great secondary deposit, extending, as is generally believed, from the Hudson to the Mississippi, and to the Rocky mountains, is in Pennsylvania limited by the Alleghany mountains, which appear to form the barrier, or dividing line between the anthracite and bituminous coal beds, or between the transition and secondary formations. The union or junction of these formations is plainly and distinctly marked in the end of the mountain, where the west branch of the Susquehanna breaks through it, above Bald Eagle, the latter resting against the former, and forming the basin in which the bituminous coal, in regular and successive strata, is deposited. The coal field is therefore confined to the west side of the Alleghany, and is supposed to extend to the centre of the mountain. In the S. E. corner of Somerset county, and in the western parts of Bedford and Huntingdon counties, it would appear to extend to the S. E. of what is there called the Alleghany, and occurs in great abundance on Wills' creek, Jennings' creek, &c. emptying into the Potomac. The chain of mountains called the Alleghany above Bedford, is very wide; and large mountains diverge from it, and although the mountain ranging through Somerset and dividing the waters of Youghiogana and Connemaugh, from those of the Potomac, may be the largest, it seems most probable that Wells or Evetts, or possibly Sideling mountain, there forms the boundary of these deposits, and upon examination will be found to exhibit a continuation of the same characteristic features between the secondary and transition formation.

The bituminous coal beds, vary from one foot to twelve feet in thickness, but rarely exceed six feet. They lie in nearly horizontal strata, with about sufficient dip to free the mines from water—some hills contain *three and four* beds, with alternate layers of earth and slate, and rest between a firm and smooth slate roof and floor. *Faults* or *troubles* are seldom met with, and in this they differ from the anthracite, and go far to confirm the opinion, that all this vast extent of secondary rocks, was once the bottom of the great lake or sea, and that it suffered little if any interruption from the gradual discharge of its waters, through its distant and widely extended boundary. It has evidently been drained by the Mississippi, the St. Lawrence, the Susquehanna and the Hudson; and it is a curious and interesting fact, that near the northern termination of this coal field, in Potter county, the head waters of the Alleghany, the Susquehanna and the Genesee rivers, flowing into the gulf of Mexico, the Chesapeake and the St. Lawrence, take their rise in an area or space of about five miles.

With the exception of the Susquehanna and its tributaries, and Wills' creek, emptying into the Potomac, all the streams rising in the coal field, west of the mountains, flow into the lakes, or into the Ohio river, and consequently the ground falls off or recedes in the same direction, and becomes too low, as is generally supposed, to contain the coal measures. Its northern termination or boundary may be traced from the head waters of the Towanda creek, in Bradford county, thence across the high lands or dividing waters of Tioga, Potter, McKean, Warren, Venango, &c., to the Ohio State line.—The Tioga river and its tributaries penetrate the coal field in the vicinity of Blossburgh and Wellsborough in Tioga county. A recent and interesting mineralogical report, upon this region, has been made, by R. C. Taylor, a practical engineer and geologist, for the Blossburgh Railroad Company, in which it is satisfactorily shown that the coal runs out as the streams decline to the north.—"There would need," says the report, "a total height of mountains of five thousand, one hundred and twenty feet, at the State line between New York and Pennsylvania, to contain the coal measures, whereas the hills, there, are probably below six hundred feet in altitude. This calculation is entered into with a view of showing the futility of the expectation, not uncommonly expressed, of tracing these coal fields in a northerly direction beyond the limits at which they are at present discoverable."—"This field being bounded on the south by the Alleghany mountain, extending into the State of Virginia, and westward; coal may be said to be present, to a greater or lesser extent, in all the western counties, with the exception of Erie, in which it has not been discovered. The counties of Bradford, Lycoming, Tioga, Potter, McKean, Warren, Crawford, Bedford, Huntingdon and Centre, lie partly in and partly out of the coal field. The counties of Alleghany, Armstrong, Beaver, Butler, Cambria, Clearfield, Fayette, Greene, Indiana, Jefferson, Mercer, Somerset, Venango, Washington and Westmoreland, are wholly within its range, and embrace together an area of *twenty-one thousand* square miles, or *thirteen millions four hundred and forty thousand acres.*" Coal has been used for fuel and manufacturing purposes, west of the mountains, from the earliest settlement of the country. It is mined, to a greater or less extent, in all the above counties, at the rate of one cent and two cents per bushel, and is thus brought within the means of all, and literally to every man's door—abounding throughout all this vast extent of territory, and fitted and used for almost every purpose requiring heat, it is impossible to form any thing like a correct estimate of the quantity consumed yearly, and sent to market. That its great abundance and cheapness have given birth to the vast and widely extended manufacturing establishments of the west, there can be no doubt. Without coal they could not exist. It constitutes the life spring of Western Pennsylvania, and the pedestal of our great manufacturing emporium.—Pittsburgh and its environs contain ninety steam engines for the various manufactures of iron, steel, glass, cotton, salt, brass, white lead, flour, oil, leather, &c. These engines consume two millions sixty-five thousand three hundred and six bushels a year. The city of Pittsburgh and its suburbs, Alleghany town, Birmingham, &c., contain a population of thirty thousand souls. "The coal consumed for every purpose, in and about Pittsburgh, is estimated at seven millions six hundred and sixty-five thousand bushels, or two hundred fifty-five thousand and five hundred tons—at four cents per bushel, the price now paid in Pittsburgh, it would amount to three hundred and six thousand five hundred and twelve dollars." "The coal consumed in the manufacture of salt, in the western counties is very great. There are on the Alleghany, Kiskiminitas, Connemaugh, Crooked creek, Mahoning, Saw mill run, Brush creek, Sewickly, Youghiogany and Monongahela, about ninety salt manufacturing establishments, and many others

about going into operation. These establishments produce yearly about one million bushels of salt, and consume five millions of bushels of coal."—'The coaking process is now understood, and our bituminous coal is quite as susceptible of this operation, and produces as good coak, as that of Great Britain. It is now used to a considerable extent by our iron manufacturers in Centre county and elsewhere."

These facts, elucidating the immense mineral wealth of the "valley of the Ohio," open to the imagination a long vista of power and greatness, which the utmost stretch of the imagination is hardly able to equal.

The *Cannel Coal* has as yet only been found in the vicinity of Cambridge, Guernsey Co., Ohio, though it is supposed also to exist about the head waters of the Muskingum, considerable masses of it having been picked up on the banks of that river, brought down by the current. We were not before aware that this most brilliant and combustible of coals had been found at all in the United States.

There is a vast amount of information in this paper, to which we would desire to advert, but know not what to select, and therefore confine our extract—having begun with coal—to the subjoined speculation upon

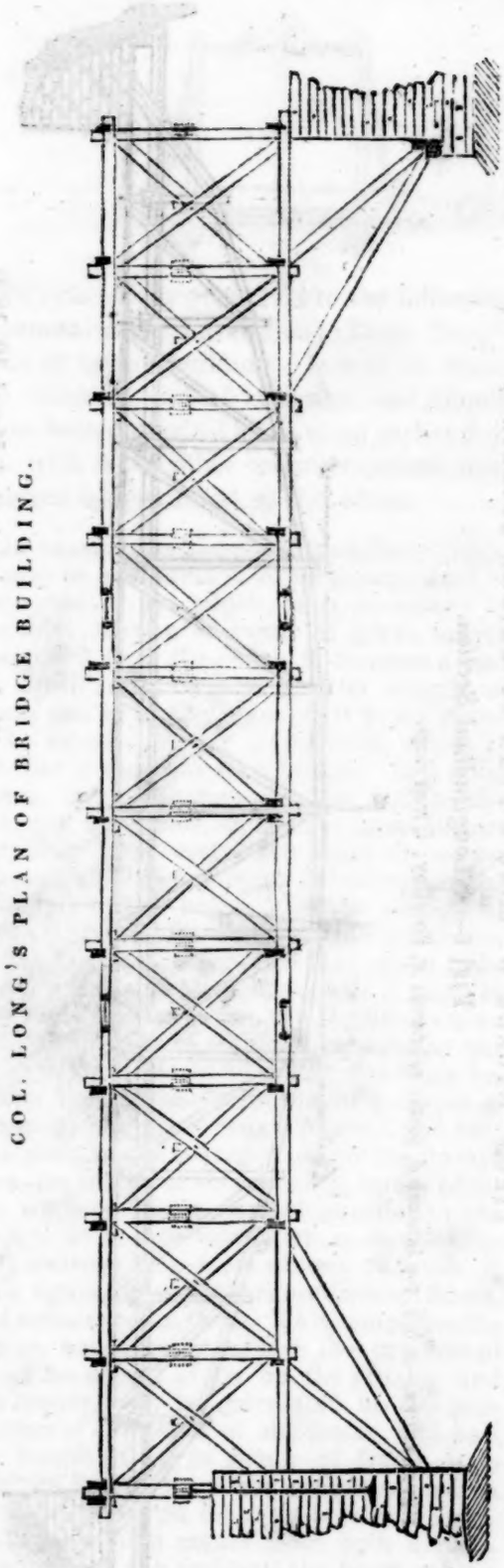
Coal Deposits.—The immense beds of bituminous coal found in the valley of the Ohio, fill the mind with wonder and surprise, as it reflects on the vast forests of arborescent plants required in their formation. Age after age, successive growths of plants, springing up in the same region, were entombed beneath thick strata of shale and sandstone, until the whole series had accumulated to a depth of more than a thousand feet: while beneath the whole, lay the bed of an ancient ocean floored with fossil salt. Indications of coal are found at intervals, across the great valley, from the Alleghany to the Rocky Mountains. It is found near the surface in Kentucky, Ohio, Indiana, Illinois and Missouri, and without doubt, may be found beneath the extensive territory deposits, which form the substratum of the great prairies in the central and northern parts of the Western States. As low down as New Madrid on the Mississippi, coal was thrown up from beneath the bed of the river, by the great earthquakes of 1812—a sufficient proof of its continuation in the most depressed part of the great valley.

That coal is of vegetable origin, no one who has read much on the subject, or personally examined the coal beds, will now deny. Time was, when it was considered a peculiar mineral product, formed in the earth in the same manner and at the same time with the rocks that surround it. The product of its chemical analysis, being altogether vegetable, and the artificial formations of coal from wood by Sir James Hall, have silenced all doubts on the subject. The only mystery now is, how such vast quantities of vegetable matter could be accumulated and grow on the spot where they were buried. That they grew in general, on the surface now occupied by the coal, appears certain from the perfect state in which the most delicate leaves and stems are preserved. Had they been transported by currents of water, and especially from any distance, it is hardly possible that they should not have received more damage. The climate, at that period, must have been both more warm and more humid than at present, as many of the plants are of those families which now grow only in tropical climates; and as the laws of nature never change, this may be deemed a correct inference. A similar climate seems to have prevailed in the latitudes north of 30°, both in Europe and in America, many of the same plants being common to the coal strata of both countries, as will be evident by comparing the drawings of several of the species found in the valley of the Ohio, with those exhibited by M. Brongniart, in his work on "Des Vegetaux Fossiles," of the European coal beds. South of lat. 30°, but few coal deposits are found, the climate requiring but little fuel for the comfort of the inhabitants; but north of that parallel, many districts could be but very thinly inhabited, or perhaps not at all, were it not for the wonderful provision of coal laid up in the bowels of the earth for the use of its inhabitants, after the forests were destroyed to make room for cultivation.

The coal deposits of Britain, by nourishing her manufactures, which have raised her to her present proud attitude among the nations, are the principal sources of her present greatness.

In the valley of the Ohio, some of the coal beds were covered with marine deposit; in others the deposit was made in fresh water, as is demonstrated from the character of the fossil shells found in the rocks, both over and under the coal. In what manner these changes were brought about, remains for future geologists to determine, after the science has become mature.

Where not removed by degradation, or buried under other strata, there seems to have been three distinct deposits of coal throughout the main coal region, embraced on the map, which accompanies these observations. After the vegetable materials which form the coal beds, were deposited or buried under the superincumbent strata, it would seem that a strong degree of heat had been applied, in addition to the pressure, before they could assume their present bituminized appearance. As we approach the coal beds, in the transition and primitive rocks, the evidences of heat are still more apparent; removing from the anthracite beds all, or nearly all their bituminous contents; and in the primitive, changing anthracite into graphite, or plumbago, which is almost pure carbon. It would appear, that we cannot reasonably doubt the action of heat on these coals, for the plumbago is evidently a coal, changed by heat into its present semi-metallic appearance, and is often produced in the furnaces of the arts, by the action of heat upon carbon. A less degree of heat has been applied to the bituminous beds of "the Valley of the Ohio," for they are far removed from any crystalline or transition rocks, on which the marks of heat are so apparent, and therefore could not receive a sufficiency to deprive them of their bituminous principles and change them to carbonaceous coal beds. The suggestion advanced by many geologists, and recently applied by Prof. Hitchcok, in his geology of Massachusetts, that graphite, anthracite and bituminous coals are all of vegetable origin, and changed by heat and pressure to what they now are, is a simple and beautiful illustration of a heretofore obscure and difficult subject.



COL. LONG'S PLAN OF BRIDGE BUILDING.

The annexed plan of, and certificates in relation to, Col. Long's Bridge, has been several months in our possession, and ought long since to have been laid before our readers. We publish a part of the certificates accompanying the drawing, which give an idea of the estimation in which the plan is held by practical men.

The undersigned, agent for Col. Long of the U. S. Engineers, offers to all persons interested in Bridges, as is believed, the most important and latest improvement which has yet been made in bridge-building.

The plan of building is such as to bring into profitable use timber of any length, and to build at any length of span from 20 feet to 300 feet between bearings.

Among the important advantages possessed by Col. Long's bridges over others, the following are believed to be peculiar to his:

All the strain on the important timbers is length wise; and this too without any material strain or thrust against the the abutments.

Any defects which time shall make, can be repaired with the same facility as the putting in of the original timber.

The work is so well secured as to admit of driving at any speed, with perfect safety, and without injury to the structure.

A great number of bridges built on this plan are already in use in the Eastern, Middle, and Western States; all of which have fully answered the most sanguine expectations of the Architects and Proprietors.

MOSES LONG.

The following selections are from the numerous recommendations of Col. Long's plan of bridge-building:

"*Baltimore and Susquehannah Railroad Office, January*, 1833.—Messrs. Hassard and Curley have constructed for this Company three bridges upon the plan of Col. Long, two of them about 70 feet in length, and the largest 100 feet. I am well acquainted with the different plans that have been adopted for the construction of wooden bridges, particularly Towne's and Burr's, which have been generally used in this part of the country, and I am satisfied Col. Long's plan is superior to any of them, in point of strength, solidity, permanency, and above all, in the facility with which it can be repaired, by replacing any piece of timber without disturbing the structure, so that by constant slight repairs the bridge

will be perpetually renewed, at a very slight expense.

"These bridges have been passed more than five months, with a steam engine and tender weighing at least ten tons, with heavy trains of carriages attached, without causing the slightest perceptible motion of any kind in the bridges, which remain in the exact position they occupied when first erected.

"My opinion in respect to these bridges is sustained by the whole Board of Directors, amongst whom there are several gentlemen who possess much theoretical and practical knowledge on this subject."

(Signed)

GEO. WINCHESTER,
President.

"The bridges above mentioned were built in conformity to my directions, as also several others on other works under my charge, and I fully concur in the opinions expressed by the President of the Baltimore and Susquehannah Railroad Company, in favor of Col. Long's plan of bridge-building."

(Signed)

WM. G. McNEILL,
Captain Top. Engineers.

I hereby certify that under the direction of Col. J. M. Fessenden, the Engineer of the Boston and Worcester Railroad, a bridge has been constructed on that Railroad over the Charles River, on the principle of Col. Long's patent. The bridge rests entirely on two abutments thirty feet in height, and has a span of a hundred and twenty feet between the abutments. Notwithstanding the distance between the abutments which are the only points of support, it has been found to be remarkably stiff, and free from yielding or oscillation on the passing of the heaviest loads, which often consist of eight or ten loaded cars, in addition to the locomotive engine and tender. It was built by Mr. Thomas Hassard of Baltimore, and has been standing a little more than a year. It is considered by the Directors of the Railroad quite satisfactory both in principle and in workmanship, and remarkably well adapted from its firmness and apparent strength, for a Railway bridge.

(Signed)

NATHAN HALE, President
of the Boston and Worcester Railroad.

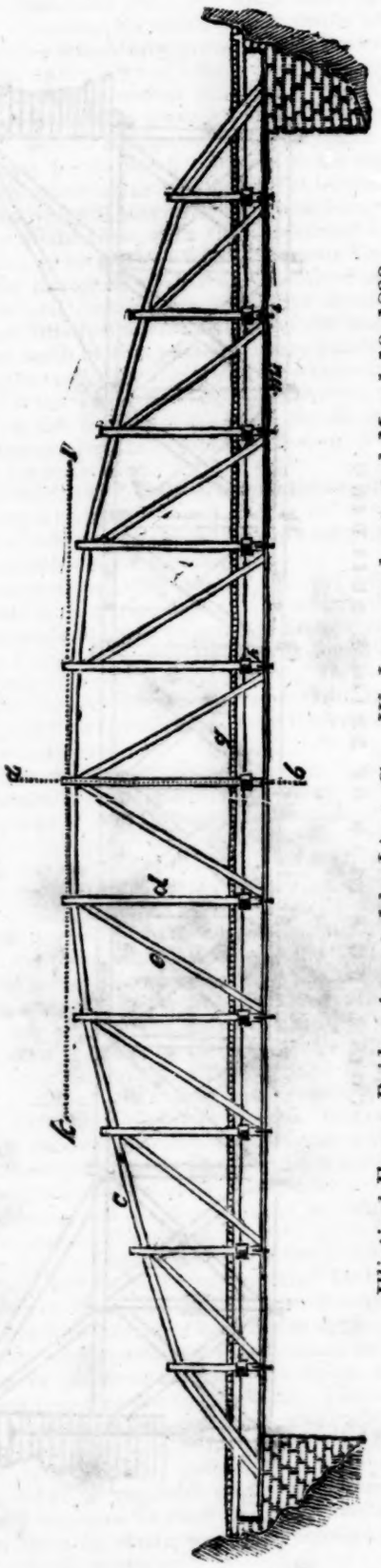
Boston, Dec. 11, 1834.

MOSES LONG, Esq., of Warner, N. H., is the agent of the patentee.

LIEUT. GEORGE W. LONG'S PLAN OF BRIDGE BUILDING.

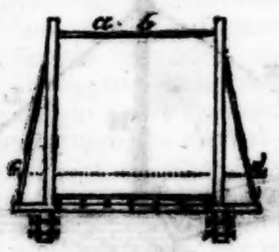
Fig. 1—*A Longitudinal Section.*

REFERENCES.—*a*, *b*, *c*, top braces; *d*, posts; *e*, braces; *g*, floorway; *i*, iron rings.



Eliptical Frame Bridge, invented by Lieut. Geo. W. Long, and patented March 10, 1830.

Fig. 2—*A Transverse Section.*



We cheerfully give place to the following communication, in relation to Lieut. Long's plan of bridge building. It will be found we think worthy of attention and should have been published by us at an earlier day, but with many other communications, was delayed by the illness of the editor.

In considering the above plan for a bridge, it may be compared to a beam supported at each end, to do which, it is necessary to consider that in a beam of great length compared with the depth, it becomes a load for itself; and that a greater length of beam can be had by reducing it to the shape to be equally strong throughout, which is all that is requisite for a bridge. In a solid beam, this reduction may be had to the shape of an elipsis, and in the frame it does not differ very essentially from the same. The above frame, then, is calculated on the principle of the beam, with the strings as the first point of fracture, and the top braces as the last, and reduced to that shape to be equally strong throughout. Or it may be explained by comparing the top braces to an arch, the thrust of which is received by the strings, and resisted by them, producing between the different sets, counter stress of the same magnitude to each other, and here this plan has advantages over other framed ones, for intead of the opposing stress of the top timbers, being carried parallel to the strings as in direction of H. L. (see the figure) andrequiring a set of ties to brink it back again, these timbers are directed down, and terminates in them. This simplifies the frame, and greatly reduces the expense of it. The actual stress on the strings and top braces, may be calculated by the proportion of the depth of the frame, and half the length of it, as depth of frame, is to half the length, so is the weight placed on it, to the stress on these timbers in weight. This proportion comes from both demonstrations, by the arch and the beam, taking the strength of the beam as the depth instead of square of the depth, as in a solid beam. This stress on the timbers, it will be seen, is in their strongest directions, and thus with a proportional depth and increased size of the setimbers, the strength of the bridge may be carried to an unlimited extent, without undue expense. The drawing shows the mechanism of the frame so plainly, that it is deemed unnecessary to give very particular explanations of it.

In 1831, the proprietor of the patent gave the use of it for a bridge over Tanners Creek, near Lawrenceburg, Indiana, for the first one constructed, the result of which was given him by the person to whom the use of the patent was given, Jonathan Woodbury, in the following words, viz.

"The patent which your liberality furnished me with, has been made use of, and instead of a bridge that would cost $12 or $15,000, the Committee which I informed you of for building a bridge, have just completed said bridge, which cost $3,130;" "its whole length upwards of 400 feet, and its width 22 feet, fifty feet high from the bed of the creek, and seventy-six (76) feet span between the piers, the whole of wood except two stone piers 19 feet high, from the bed of the creek, and framed timbers upon these piers for the arch to rest upon, the other part of the bridge is on bents 20 feet apart, all finished in a workmanlike manner." "That part which we are indebted to you for, is thought to be the best model ever yet found out, both as to strength and cheapness."

"The strength of your patent is thought to be almost beyond calculation, by a comparative view of its cheapness, and the size of its timbers; and should it prove as good as we now anticipate, I have no doubt but it will be a source of income to you; we shall have a fair experiment of all its qualities."

The size of the timbers given for the above bridge, was 8 inches square. The bridge is yet standing (1835) and has, so far answered the public expectations, and others are now building in the same neighborhood.

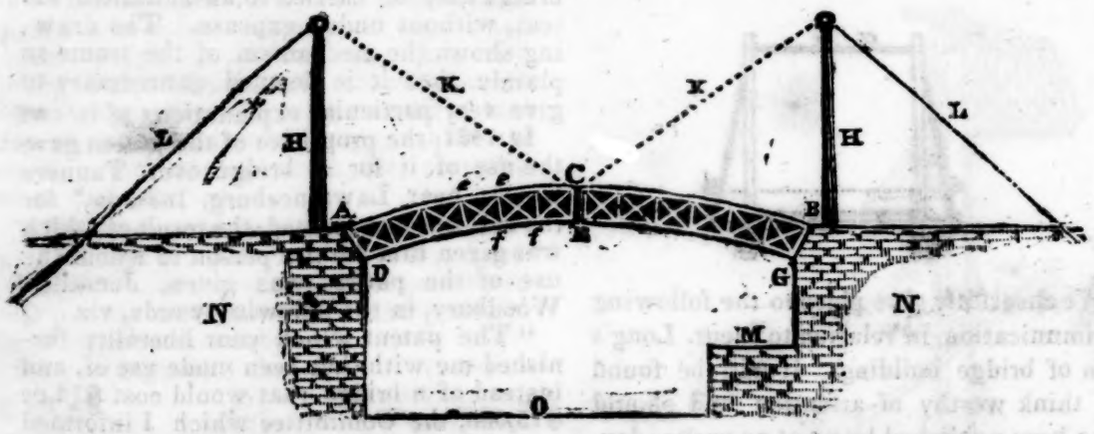
[George W. Long.

Chambly, Oct. 24th. 1835.

D. K. Minor, Esq.

Dear Sir,—I am anxious to try steamboats on the Canal that is at the point of completion here. I have a schooner which is well calculated to receive an engine of ten or twelve horse power, and would put one in her if I could get it cheap. Will you please to advertise in such a way, for a small engine, that I need not be obliged to take it, if beyond my means of payment. I should like a second hand one, and if high pressure, I should not object. Will you let me know the answer to your advertisement, and if an engine is offered cheap, I will come on and see it.

HOPKINS' CAST AND WROUGHT IRON DRAW BRIDGE.



I have just been making a cast and wrought iron draw bridge, of 35 feet span, of which I send you a sketch; it cost $1500, stone work and all.

From A to B is 36 feet, the versed sine of the arch is 2 feet, and the depth of the rib from C to E is 2 feet. The bridge is composed of 3 ribs, like the one A C B E, braced together, and planked over the top. The upper bar A C B, and the posts *e f*, *e f*, are composed of iron cylinders (cast), through which wrought iron rods are passed; the cylinders are 2½ inches in diameter, and the rods passing through them are 1¼ inches; the rods passing through the post cylinders have eye bolt heads, and the rod that threads the upper cylinders passes also through these eyes; the post rods pass through the lower bar D E G, which is of wrought iron, ½ inch by 3 inches; the braces should be hollow cylinders, whose exterior diameter is 1¾ in., and which are ½ in. thick; but it was found difficult to cast them here, and they were cast feathered. At G and D are cushions of wood to receive the bridge, in descending the posts. H H are hollow cylinders, furnished at top with a cross rod and drums for the lifting chains K K, and a counterpoise of 6 cwt.

The weight of iron is,

Cast Iron, . . .	14,312 lbs.
Wrought Iron, . . .	9,389

You will see that the object in making the upper part of the bridge cast iron was to resist the crust, and that the lower part was wrought to resist extension.

Will you send me your Canal Map?

Your obedient humble servant,

WM. R. HOPKINS.

[From the American Railroad Journal]

SIR—My attention was forcibly drawn to the remarks of your correspondent, in the January number of the Journal, on the subject of Suspension Bridges, and more especially with his liberal and magnificient design of erecting such a structure at the Fulton Ferry. The views of that gentleman are worthy of the enlightened state of the arts, and in keeping with the advancements of the age; and although the measure he proposes has elicited no public attention, that I at this distance am aware of, it has doubtless made a permanent impression upon the minds of those within whose peculiar province it falls.

It is not my intention to say any thing in addition to the subject of his communication; but as it is connected, in my mind, with the design of this paper, a recurrence to it serves as a suitable introduction to a notice of a Bridge upon a new plan, which the inventor is about to patent, and which, to my view, seems to possess a peculiar adaptation to the site of the Fulton Ferry, whilst its general application would not be less profitable in minor constructions.

A Bridge of the form that I am about to speak of, may be termed (without impropriety, I suppose,) a Suspension Bridge; but the important point on which I differ from those at present known, consists in the employment of continuous bars of wrought iron, instead of chains made up of links; thus (ceteris paribus, diminishing the weight of the metal one half, and probably in the proportion of two to five, and also) enabling the architect to extend his bars much more tensely than can be done with chains in the present mode of erection. Indeed, in a span of one hundred or one hundred and fifty feet, the tension can be given so as to present but a slight departure from a straight line, and the curvature will be nothing more than that which results from the elasticity of the metallic bars themselves.

It is proposed to secure these bars, at their extremities, and to pass them over abutments (and peers where they may be required by the breadth of the stream,) in a manner no wise different from the usual chain-fastenings; but as they will assume

but a very slight curve from *sagging*, compared with the catenarian curve, which gives a corresponding obstruction to the waterway, unless the suspension towers have considerable elevation, these abutments will be required to be raised but to a moderate height above the surface of the stream, thus reducing to a great extent the cost of a bridge in all situations, and demonstrating the practicability of its erection on sites where otherwise the expense would not admit of them for many years to come, and in some, most probably, never.

Moreover, a Bridge of this construction may be provided with a draw, upon a plan, which I believe, is equally novel and ingenious. This is to elevate the two piers, inclosing the draw, to a height sufficient to pass the tallest vessel that may apply, and over these to extend a second series of the continuous bars, terminating in braces, which may be securely fastened in various ways at the ends. The moveable floor is suspended from these by pendulous rods, whose upper extremities are attached to the axles of two or more flanged or grooved wheels, plying upon the upper series of bars in such manner that when the draw is closed, the wheels repose in the midway of the opening, and as it is opened, recede *pari passu*, with the floor towards the pier. If a Bridge on this plan were built at a point of great thoroughfare, an accessary pathway for foot passengers might be made by a stairway over the summits of the piers, while the opening of the draw would only obstruct the passage of vehicles.

In addition to economy of construction, the inventor thinks it is an important feature, that if any parts need renewal, they may be removed without impairing the strength, and replaced by others, and thus the whole structure be consecutively renewed, like the gradual absorption and deposition of the particles of the living frame.

It was not my purpose to say more (nor indeed so much) of the form of this Bridge at present. That objections may be suggested against it, I have no doubt, but I think they are all susceptible of removal or obviation, and none can apply that do not attach with much greater force to Chain Bridges, whose utility and adaptability to the most critical and difficult situations are not now matters of question. My object was to call to it the attention of those of your readers who are more qualified by their habits and experience to judge of its claims, and perhaps to draw forth their opinions. S. M.

Baltimore, March 12th, 1835.

Accompanying this communication we received drawings of two forms of this Bridge, both intended for draws, and one in illustration of the stairway, for foot passengers. They were not intended for publication, yet they are at the service of any gentleman who may desire to examine them. The plan certainly has novelty, if no other merit for its recommendation—and we ask for it an attentive perusal.

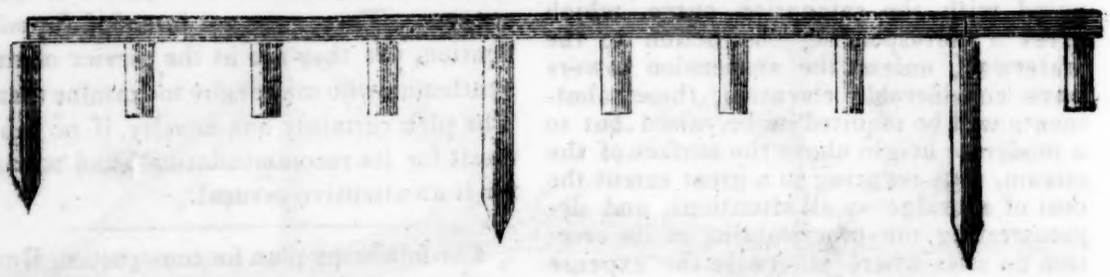
The following plan for constructing Railroads, is submitted for the consideration of our readers. It will be found useful, in many parts of the country, for passing soft or marshy ground, and perhaps for the construction of cheap roads. We are truly obliged to Mr. Haskins, as we are to every gentleman, who favors us with his views on the subject of Railroads.

Mr. Minor,—I subjoin, for your publication, a plan for constructing Railroads, which, so far as I know, has not been advanced by others, and which may be found useful. I made a suggestion, some four years since, embracing the principle, in an article upon the Mad River Railroad, which appeared in one of our public journals. In April last, I drew out a plan and specifications, and submitted them to the Directors of the Aurora and Buffalo Railroad Company; since which, some copies thereof have been obtained for Engineers upon other works for examination.

Durability, and the *maintenance of fixed levels*, are matters of the first importance, in Railroads. I believe Engineers do not estimate the durability of these works, when constructed upon any one of the most approvad plans at present in use, at over ten or twelve years; that is, without expenditures which almost equal the cost of rebuilding upon the same grade. If this is so, I believe the subjoined plan for constructing will prove valuable; for, while its cost will be found (where suitable timber is plenty) intermediate between the *most* and the *least* expensive Roads that have been made, it will produce a Road which, without any material repairs, will maintain its level, and remain good from sixty to eighty, and in some cases even one hundred years. I know full well that *driving piles* is nothing new in Railroad construction. Over marshy grounds these Roads have always been carried on piles, but on dry ground, the expense would be too great to drive as many piles as would be needed for *all* the rests. The proposed plan is designed to secure a fixed level for very long periods of time, without undue expense. The grading will be the same in this as in other cases.

The engraving below, exhibits a vertical

HASKINS' PLAN FOR CONSTRUCTING RAILROADS.



section of Road, the stretchers which are to receive the rails, resting at either end, upon piles driven into the earth, and intermediately upon blocks of wood. The stretchers and piles are each one foot through, and the blocks the same. The piles varied in length, as the soil varies in which they are to be driven, the depth being always such as to secure their firm position, against the action of frost, or of rains, in softening the soil. Piles thus driven, at distances to accommodate the length of the stretchers, when cut off to the grade, become *fixed points of level.* The blocks—used intermediately, to save expense—to have sawed, parallel ends, and to be adjusted to the same level as the piles, the earth being driven in tight around them. Their length I have assumed at three feet. When at hand, a flat stone might be laid beneath each block, with advantage. These blocks, by the use of the Road, will, in time, settle more or less; but, as each end of the stretchers remains *fixed* upon the piles, these central depressions may, at any time, be elevated to a horizontal line, by wedges driven under the stretchers, upon the heads of the blocks—a process alike cheap and effectual.

The length of the stretchers, and the distance between the supports, or blocks, will be matters of consideration. The former I have assumed at twenty feet, and the latter four feet. Probably, as the stretchers will rest upon the soil, the distances between the supports may, in many Roads, be considerably greater than this. The stretchers should be tied, at suitable distances; though few ties will be necessary, if the stretchers be firmly bolted to the heads of the piles. These ties, when a horse-path is intended, should be cut away in the centre, so that the gravel of the path will form a smoother surface above them.

The piles, blocks, stretchers, and ties, which constitute *the whole work*, except the iron rail—if of beach, cedar, or locust, and cut in winter, will exceed in durability the extreme of human life.

R. W. Haskins.

Buffalo Sept. 4, 1835.

To the Editor of the Railroad Journal:

Mr. Minor, Sir,—In your Railroad Journal there has been much said on the subject of the tenacity or cohesion of iron, but in regard to the particular shape or form for Rails, (for wear and economy,) I am not aware that the subject has been much dwelt upon. From my observations of the different Railroads that I have seen, I am convinced that there is an immense difference in the economy and wear of the different kinds of Rails, and have no doubt that it is owing to the different shapes that the iron is wrought into, more than to the quality of iron used in their manufacture.

I have observed a great difference in regard to the splitting and scaling of Rails, by compression, (*from use*)—it appears to me that the flat or plain Rails can, and would be wrought more compact, and in wear there would be at least 50 per cent. in their favor.

From conversations with many of the Directors of Railroads, I have not found that the subject has been much thought of. The safety in travelling on Railroads depends much on the solidity or compactness of the iron. The Rails that split or scale the most, must of course be more dangerous; the next consideration is economy in their results, for long use, and not for the mere consideration of their first cost only.

Will some of your numerous correspondents take the subject into consideration?

Yours obediently,

P. Fanning.

We cannot reply to the above questions for want of experience, and therefore call upon those of our practical and experienced friends to answer them for us, through the Journal.

It is important that this subject should receive attention, and we are ready to do our part, *publish* it, when we receive the answer.

[From the American Railroad Journal.]

QUERIES TO ENGINEERS.—We have been requested to submit the following queries to the consideration of Engineers, and to request replies to them through the Journal.

1st, What rate of ascent per mile is preferable for the use of locomotive steam power, to that of stationary, upon a straight line of Railroad, the distance the same in both cases, the cost for construction the same in both cases, the freight, passengers, and as many as can be transported upon a good permanent double tract, upon a level Road?

2d, What rate of ascent per mile is preferable for the use of locomotive steam power, upon a curved line, say 1000 feet radius, to that of stationary power, by making the curves between the planes of a smaller radius, say 500 feet, and the planes for stationary power on straight line, distance, cost, and transportation, as before mentioned?

3d, What rate of ascent per mile is preferable for the use of locomotive steam power, to that of stationary, as in the 1st and 2d question, provided the transportation is only half the Road is capable of doing?

4th, What rate of ascent per mile is preferable for the use of locomotive steam power, to that of stationary, as in the 1st, 2d, and 3d questions, with the exception of passengers, as freight and transporting produce and merchandize?

5th, What extra distance is equal, by going around an elevation and depression, to that of going over at the rate of 60 feet per mile, for a distance of 2 miles, 1 mile each way from the summit, the level the same on both sides of the ridge, the curves the same in both cases, the cost for construction the same in aggregate, transportation to be passengers, as in the 1st question?

6th, We will fix the rate of ascent for locomotive power, at 60 feet per mile for this question, and say, we have 10 miles to ascend at the same rate, for the transportation of passengers, as in the 1st and 2d question, cost for grading is $10,000 per mile=$100,000, and further say that a location can be made near the one proposed, by rising 40 feet per mile, for the 1st 5 miles, and the remaining 5 miles will ascend at the rate of 80 feet per mile, this location will cost less money than the 1st, how much less should it cost to make it equal to the 1st, distance the same in both cases?

I have asked the above, questioned in that simple, plain, and pointed way, in order to prevent the gentlemen avoiding the answers of some kind.

RAILROAD BARS.—We find in the London Mechanics' Magazine, the following remarks in relation to a mode of avoiding the jar which occurs in passing over the pedestals, or supports, of the rail.

RAILROAD BARS.—Sir: I have not hitherto directed particular attention to railroads, but as I read Mr. Daglish's letter of the 26th May, an idea occurred to me, which I am induced to offer, through your columns, to the consideration of those connected with great undertakings of that kind. I will put my idea as a question:—Is it not possible to produce a railroad with uniform elasticity, or, at least, so nearly so as to avoid the inconvenient and injurious jar experienced while the wheels of a carriage are passing over the pedestals and joints?

To effect this, I propose that the ends where the different portions of the rails meet should have corresponding notches to admit keys, for the purpose of keeping all fair at top. These keys might be extended to the rails on both sides of the road, to keep them parallel and at a uniform distance. The vertical joints where the ends of rails meet to be open, to allow for expansion; and for the same reason also, the vertical joints at the sides of the keys. Horizontally the keys to be as tight as possible in the rails. The rails are to be kept in their vertical position by the mortices in the chairs, and to be fastened down to them by the keys. Each portion of the rails is not to rest on the bottom of the mortices in the chairs, but upon a transverse bar or bars, whose strength and bearing are to be precisely that which will produce the same degree of elasticity as that of the rails, that is, if the wheels of a waggon were passing immediately over these bars, or the keys in the joints of the rails, there would be no more tendency to jar than if they were rolling on the rails in the middle between any of the supports.

This idea may be applied to a great many, or all the variety of forms for the rails; but I think with Mr. Daglish, that the rails, from their upper to their under surface, ought to be as little as possible. And, indeed, to produce steadiness in motion, the centre of gravity of a train of carriages, and the goods they contain, cannot be kept too low.

I am, sir, your obedient servant,

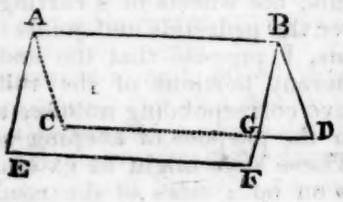
JOSEPH JOPLING.

31, Somerset-street, July 11, 1835.

On the Resistance of Fluids; by GEO. W. KEELY, *Professor of Natural Philosophy, in Waterville College.*

SIR,—I perceive in No. 55 of the Journal, that Professor Wallace has announced a new measure of the resistance of a fluid in a direction perpendicular to a plain surface moving in it, viz: That it is as the sine

of the inclination of the plane. Permit me to state my reasons for adhering to the old doctrine, that the perpendicular resistance is as the square of the sine of inclination. It is well known that the latter measure has been deduced from the alleged facts that the *number* and the *force* of the resisting particles vary as the sine of the inclination. If it be true that the resistance to a plane surface moving in a fluid is as the number of particles it strikes in its course, and that the number of particles in any indefinitely thin fluid lamina is as the area of that lamina, (neither of which we think Professor W. will deny,) it follows that, if BD be a section of a plane inclined to the direction BA of its motion, and BF an equal section of an equal plane perpendicular to the same direction, the number of particles BD will strike is to the number that BF will strike in the same time, as the parallelogram ABCD is to the parallelogram AEFB; and the resistances are therefore, on this account, as BG is to BD, or as the sines of the inclinations of the sections; the resistances to the planes are of course in the same ratio.



Now this familiar demonstration would seem to settle the question; but Professor Wallace argues, "that the number of particles striking the plane does *not* depend on the breadth of the fluid column BG BF, but *on the surface of the plane*, because the particles that act on the plane are those in contact with it, and therefore their number is as its superficial area." Now, admitting it to be true that the number of material particles in contact with the plane, at any instant, is the same, whether it be perpendicular or inclined to the direction of the motion, it does not, we think, necessarily follow that the number of particles struck in any given time will be the same. But neither is it evident that the number of particles in contact with the plane is the same for every inclination of the plane. The burden of proof, however, seems to lie with Prof. W. He has *assumed* the general physical fact that the number of particles in contact with the plane, at any instant, is the same for any position of the plane, and he has deduced an inference, not formally expressed, indeed, but surely implied, otherwise the argument is worth nothing, that the number of particles struck in any given time is as the number in contact with the plane at any instant. Now we think the fact and conclusion may very safely be denied, and it becomes Prof. W. to show that they are consistent with some hypothesis respecting the form and relative position of the ultimate particles of a fluid body. In any hypothesis, we believe the following positions will be found to hold:

First. Whether the number of particles, at any instant, in contact with the plane, in different positions, is the same, depends wholly on the hypothesis.

Second. If the number is the same in different positions, it will be found that the number of fluid strata struck in any given time, is as the sine of the inclination.

Third. If the number is *not* the same, then it varies as the sine of the inclination, and the number of strata struck will, in any given time, be the same.

If Prof. W. can devise any hypothesis with which these positions do not agree, we will allow he can disturb our belief in the truth of the law of the square of the sines.

The wide difference between the results of observation and those of the old theory, would tend rather to dissuade us from admitting the truth of the new, when we consider what important physical circumstances are and must be omitted in the conditions.—[Silliman's Journal.]

[From the Repertory of Patent Inventions.]

Specification of the Patent granted to HENRY BOOTH, *of Liverpool, for Compositions or Combinations of Materials applicable for the Greasing of the Axle-Bearings of Carriages, and the Axle-Spindles and Bearing-parts of Machinery in general, denominated Patent Axle-Grease and Lubricating-Fluid.*

Mr. Booth says, my patent axle-grease and lubricating-fluid are chemical compounds of oil, tallow, or other grease, and water, effected by means of the admixture of soda or other alkaline substance, in such proportions that the compounds shall not be of a caustic or corrosive nature when applied to iron or steel, but of an unctuous greasy quality, easily fusible with heat, and suitable for greasing the axle-bearings of carriage-wheels, or the axles, spindles, and bearings of machinery in general. And the proportions of the ingredients for the said compounds, and the method of compounding them, which I recommend as suitable for the above purposes, are as follow:—

For the axle-grease suitable for carriage-axles, and particularly for the axles of every description of railway carria-

ges, a solution of soda in water, (the common washing soda of the shops,) in the proportion of half a pound weight of soda to a gallon of pure water; to one gallon of this solution add three pounds of good clean tallow and six pounds of palm-oil; or, instead of the mixture of tallow and palm-oil, add ten pounds of palm-oil, or eight pounds of tallow, (the tallow being of a stiffer nature than palm-oil.) The said tallow and palm-oil, or either of them, and the solution, as described, must be heated together, in some convenient vessel, to about 200° or 210° of Fahrenheit, and then the whole mass must be well mixed and stirred up together, and be agitated without ceasing till the composition be cooled down to 60° or 70° of Fahrenheit, and have obtained its consistency, which will be that of grease or butter, in which state it will be ready for use, and may be applied in the way in which grease is usually applied to machinery.

For the lubricating-fluid, which, also, is applicable to the rubbing parts of machinery, (and particularly to the spindles of pulleys on inclined planes moving on wooden bearings,) I recommend to be taken of the aforesaid solution of soda in water, one gallon; of rape-oil, one gallon; and of tallow or palm-oil, one quarter of a pound weight: heat them together to 200° or 210° of Fahrenheit, and then let the fluid composition be well stirred about and agitated without intermission till cooled down to 60° or 70°, when it will be of the consistency of cream: or if a thicker consistency be desired, a small addition to the tallow or palm-oil may be admitted; and in all cases it is advantageous to shake or stir up the mixture immediately before using it.

Now, though I have given the foregoing proportions of ingredients, as suitable, under ordinary circumstances, I do not mean to limit the invention to these precise mixtures; as according to the temperature of the weather, or the particular purpose to which it may be applied, a little more tallow or other grease or oil, and less of the solution may be desirable; or slight alterations in the quantity of soda for the solution, or in the relative proportions of tallow and palm-oil or other grease, may be found advantageous—a larger proportion of soda in the solution, and a larger quantity of tallow in proportion to the solution, rendering the compound stiffer, and less easily fusible in hot weather; all which modifications of my patent compounds will be easily adjusted by the superintendents of the machinery to which they may be applied. In witness whereof, &c.

Enrolled June 4, 1835.

[From the same.]

Specificatian of the Patent granted to Joseph Ferguson, *of the City of Carlisle, in the County of Cumberland, Manufacturer, for a certain Combination of Processes whereby a new kind of Dress or Finish is given to certain Goods.* Sealed December 23, 1834.

To all to whom these presents shall come, &c. &c. *Now know ye*, That in compliance with the said proviso, I, the said Joseph Ferguson, do hereby declare the nature of my said invention to consist in giving a new kind of dress to twilled, plain, or figured cotton goods, which have been beetled by submitting them to certain known processes, not heretofore applied, after beetling, to produce that effect. And in further compliance with the said proviso, I, the said Joseph Ferguson, do hereby describe the said processes and the order in which the same are to be applied, by the following statement thereof, (that is to say):

I take plain, twilled, or figured cotton cloths beetled in the usual way by a beetling-machine for fifty or sixty hours, in order to bring them to a very high gloss, and put them over a damping-machine so as to be completely saturated with water. I then put them through a drying-machine with copper cylinders and heated with steam in the usual way, taking care to put them through, when twilled, as tight as the cloth will bear without tearing, so as to open out the twill as much as possible during the drying process; when the cloths are plain, or figured, only, and not twilled, then the usual degree of tension applied to goods in drying-machines will be sufficient, and in all cases it is preferable that the heat and speed of the drying-machine be such as to dry the cloth completely by the time it gets once through, provided the color, (if dyed goods,) be such as to admit of it, if not, it should be dried at two or more operations.

The stiffening of the goods should in all cases also be particularly attended to, inasmuch as the more firmly they are stiffened, whether before or after beetling, the more defined and perfect will be the dress.

Now whereas I claim as my invention the combination of the damping or saturating and subsequent drying processes with the process heretofore in use to produce beetled goods, as hereinbefore described, and applied to the purpose of giving a new kind of dress or finish to such goods as aforesaid. And such my invention being, to the best of my knowledge and belief, entirely new and never before used within that part of His said Majesty's United Kingdom of Great Britain and Ireland called England, His said dominion of Wales, or town of Berwick-upon-Tweed, I do hereby declare this to be my specification of the same, and that I do verily believe that this my said specification doth comply, in all respects, fully and without reserve or disguise, with the proviso in the said hereinbefore in part recited letters patent contained; whereof I do hereby claim to maintain exclusive right and privilege to my said invention. In witness whereof, &c. Enrolled June 23, 1835.

[From the same.]

Tables of Discounts, Net Proceeds, and Per-Centage Profits upon the Sale of Goods: on a New Plan of Arrangement: being more comprehensive and more expeditious for consultation, than any hitherto published. By DAVID BOOTH, Author of the Interest Tables, &c. &c. London: Simpkin, Marshall, & Co.

The recording of improvements from time to time made in our *manufactures*, may perhaps be supposed to include the noticing of any thing that may tend to the advantage of the *manufacturer;* and to this supposition we attribute our being favored with the work before us, which holds out the advantage of enabliug the manufacturer to calculate his discounts, and reckon up his profits more expeditiously than heretofore.

We will describe, rather than attempt to review, this publication, as to do that properly would require that we should calculate the Tables to prove their accuracy,—a task we cannot undertake;—but supposing them to be correct, we conceive that this work must be invaluable to manufacturers, whose goods are sold subject to various discounts. The Tables are assorted in pairs, fronting each other. The one page gives the amount of discount on any given sum, at the rate marked at the top (that is, at $1\frac{1}{4}$, $2\frac{1}{2}$, $3\frac{3}{4}$, and so on, up to $48\frac{3}{4}$ per cent.,) and the opposite page gives the net proceeds of such sum, or amount remaining after the discount is deducted. To the general tradesman this work must be equally useful, enabling him to calulate his profits with great facility. We therefore conceive that we are rendering to our manufacturing and trading readers a useful service by recommending them to possess themselves of these Tables.

THE BRISTOL AND GLOUCESTERSHIRE RAILWAY (from Bristol to the great Westerleigh coal-field) was opened on the 6th inst. It is 9 miles long; and the cuttings and embankments are supposed to be greater than on any railway of similar extent which has yet been formed. There is a tunnel (under Staple Hill) 1,540 feet long, 12 wide, and $16\frac{1}{2}$ feet high; it is in a straight line, 3 shafts by which the excavations were carried on being left open to admit light. One of the embankments is 56 feet in height. The capital expended on the undertaking is about 77,000*l.* The Act was obtained in June, 1828, and the works were commenced in June, 1829. Mr. Townsend is the engineer.

LIVERPOOL AND MANCHESTER RAILWAY—*Seventh Half-Yearly Meeting.*—The Directors reported a continued increase in the traffic, as compared with the corresponding six months of last year. The receipts of the half year ending 30th of June, amounted to 99,474*l.* 16*s.* 6*d.*, and the expenses to 61,814*l.* 6*s.* 1*d.*, leaving a net profit for six months of 37,660*l.* 9*s.* 10*d.* A dividend of 4*l.* 10*s.* per share (for the half year) was resolved upon. The shares are now quoted at 200*l.*

STEAM CARRIAGES ON COMMON ROADS.—Mr. WALTER HANCOCK performed a journey of 75 miles, from London to Marlborough, in his steam carriage, the *Erin*,—originally called and described in this journal as the "*Era*." The time occupied was about twelve hours, seven and a half of which was running time, as will be seen by the following account:—

JOURNEY FROM LONDON TO MARLBOROUGH IN MR. WALTER HANCOCK'S STEAM CAR-

RIAGE, THE "ERIN."—Sir: The "Erin" steam carriage, which was built by Mr. W. Hancock to run on the Paddington road, and originally called the "Era," (described in your journal, No. 585) started from Stratford on Tuesday morning last, at half-past four, for Marlborough, with a party of gentlemen. Mr. Hancock had attached a small tender to the carriage, containing coke and water sufficint to have lasted us to Reading; but the bar of wood, through which the bolts ran that fixed the tender to the carriage, gave way in Cheapside, and we were obliged to leave the tender behind us.

The carriage reached Hyde Park corner by six o'clock, where we remained about half an hour to take in some of our party, and proceeded on to Reading, which we reached at 11 minutes past 11 o'clock. The company stopped there an hour and a half and dined; after which the journey was resumed.

The carriage reached Marlborough by half-past 6 o'clock, with no other accident than the breaking of one of the bands of the blower. The total time on the road was a minute or two short of 12 hours, of which 4½ were occupied in stoppages, leaving 7½ hours for travelling the 75, being at the rate of just 10 miles an hour.

No one who has not travelled by steam carriages can imagine the inconvenience and delay which results from the want of regular and ample supplies of water; the carriage having to stop from 14 to 18 minutes every 10 or 12 miles to fill the tanks by hand-buckets from pumps, with sometimes the additional inconvenience of having to take the supply from some neighbouring stream or pond. While the carriage is stationary, the fire slackens in consequence of the blower being stopped, and it requires about two miles running to get it again into full play. By observations which I made on the road while timing the carriage, I found that the rate of the first three miles, after taking in water, averaged 7½ minutes a mile, whilst the latter part of the distance, till the carriage again stopped for water, averaged one mile in five minutes. Frequently the men were obliged to use any kind of water they could get; some being filled with duck-weed, straw, and filth of every description, which, of course, very much retarded the generation of steam. The inconveniences arose in the present case chiefly from the loss of our tender, which would have carried us to Reading without any stoppage.

All these delays would, of course, not happen, if water stations, having tanks with large hose, which might fill the carriage in a minute, were provided. There is no doubt, that had such arrangements been made for supplying the "Erin" on the present journey, it would have performed it, including stoppages, in 6 hours; though the carriage was not built, I am informed, nor intended for long journeys, but for such short distances as between London and Paddington.

Mr. Hancock started from Marlborough to return to London on Friday at half-past five. The carriage accomplished the ascent of Marlborough hill—the steepest acclivity on the Bristol road, being full one mile long, and having a rise of about 1 in 7, in 6 minutes, with a stoppage of 4 minutes. The "Erin" reached Reading by 10, and stayed 1½ hour for breakfast. After running through the town we continued our journey, and reached London by half-past five, being again 12 hours on the road, and having lost nearly about the same time in stoppages as on our journey down.

Our reception on the road was very cordial; there was scarcely any manifestation of bad feeling throughout the journey; indeed, wherever we stopped to take in water, we had every assistance given us by the bystanders. We were particularly well received at Marlborough, where we stayed two days. The carriage made a trip through the town each day; and Mr. Hancock astonished the inhabitants by the easy manner in which he could turn, stop, or back his carriage. Two gentlemen of Marlborough most hospitably entertained the steam travellers whilst they remained in that town.

Subjoined, I give a table of the performances of the steam carriage taken from the notes of the gentlemen who timed the carriage.

And remain, yours truly, R.

London, August 10, 1835.

Messrs. MAUDSLEY AND FIELD performed the same distance in five hours 49½ minutes, running time.

JOURNEY FROM LONDON TO MARLBOROUGH BY MESSRS. MAUDSLEY AND FIELD'S STEAM CARRIAGE.—The journey from London to Marlborough has been also recently performed by the steam carriage constructed by Messrs. Maudsley and Field for Sir Charles Dance, Mr. Macneil, and other gentlemen. We extract the following statement of its performances from a letter of Mr. Macneil to the newspapers. It will be seen that the rate of speed realized was nearly the same as in the case of Mr. Hancock's "Erin;" but the time occupied in stoppages was less, owing, no doubt, to

better arrangements having been made for the supply of water:—

"Time on the road in going down	8	10	30
Deduct stoppages - - - - - -	2	21	4
Total time while moving - - -	5	49	26

Which gives about 12·86 miles per hour whilst running.

Time returning - - - - - - -	11	22	0
Deduct stoppages - - - - - -	4	2	0
Total time moving - - - - - -	7	20	0

Which is rather more than 10 miles per hour whilst running."

[From the American Railroad Journal.]

On the Location of Railroad Curvatures; being an Investigation of all the Principal Formulas which are required for Field Operations, in laying Curves and Tangent Lines, to pass through Given Points. By J. S. Van De Graaff.

(Concluded from vol. vi., p. 160.)

27. The preceding articles, with their obvious combinations, embrace all the cases which can occur in the field, by a method of computation rigorously accurate, and of convenient application. But before closing this part of the subject, the following example will be here given, as a general illustration of the method to be pursued when an alteration is proposed in a line after the completion of a location.

Let D A F A′ G L represent a located line having the following character: D A, a tangent; A F, a curve, modulus of curvature 2° 3′, and length 18 chains; F A′, a tangent, length 9 chains; A′ G L, a curve, modulus of curvature of the part A′ G, 2° 52′, and length of the same part, 15 chains. Now, it is proposed to remove the origin A 4 chains *back* upon the tangent line D A, to a station B; and to lay a curve B R 15 chains, with the same modulus of curvature, 2° 3′; and it is required to know what would be the direct distance R Q between the two curves from the point R. And if a tangent R X′ be laid from the point R, it is also required to know the proper position in that tangent line, for the origin B′, and the necessary modulus of curvature, in order to trace a new curve B′ G in such a manner as to pass again into the original line G L with a common tangent at the station G.

Because B R = 15 chains, and B A = 4 chains, the difference is 11 chains, and the curve A Q will therefore obviously contain more than 11 chains when R Q is normal to the tangent R X′. Hence, taking the station Q at the extremity of 13 chains, the data for computing the line R Q by means of (XXV.), will be, T′ = 2° 3′, $n = 13$, $m = 15$, and $\propto = +4$; or, $2n\mathrm{T} = 53° 18'$, and $2m\mathrm{T} = 61° 30'$; and therefore $w = \left\{ \frac{\cdot 01022}{\cdot 00256} - 4 \times \frac{\cdot 87882 - \cdot 80178}{\cdot 03577} + 16 \right\}^{\frac{1}{2}} = (4\cdot 00 - 4 \times 2\cdot 153 + 16)^{\frac{1}{2}} = \sqrt{11\cdot 388} = 3\cdot 38$ chains nearly = R Q. And by (XXVI.), Cos. $\mathrm{P} = \frac{1\cdot 076 - 4}{3\cdot 38} = -\cdot 8651$; that is, $\mathrm{P} = 210° 6'$. Hence, the angle Q R X′ will evidently be expressed by $2m\mathrm{T} + 210° 6' - 180° = 91° 36'$; which being nearly a right angle, proves that 13 integer chains in the curve A Q, corresponds most nearly with a true normal line Q R. The length of the line Q R furnishes the data by which to judge of the situation of the ground at the point R.

The origin, and curvature of the new curve B′ G, will now be investigated by means of (XVII.) and (XVIII.) Let any arbitrary point K be selected for the origin of a system rectangular axes K X′, K Y′; and compute the values of the co-ordinates A′ H′, H′ K, of the origin K, taken with reference to the rectangular axes which have their origin at A′.

In such a case as the present, it would be most convenient to take the point K coinciding with the station R; but in order to retain the results given in a former example, take R K = 12 chains; and the values of the required co-ordinates will then be, A′ H′ = + 1·37 chains, and H′ K = + 1·58 chains.

The co-ordinates of the point G, taken with reference to the axes K X′, K Y′, may now be computed by means of (XXI.), after the co-ordinates of the same point, taken with reference to the axes at A′, have been determined by (VII.) To find these latter co-ordinates, the given data are, T = 2° 52′, and $n = 15$; or, $2n\mathrm{T} = 86°$. Hence, by (VII.), $x = \frac{\cdot 99756}{\cdot 10002} = 9\cdot 98$ chains, $y = \frac{\cdot 93024}{\cdot 10002} = 9\cdot 30$ chains. Now, the data necessary for computing the new co-ordinates by means of (XXI.), are, $\propto = +1\cdot 37$, $\beta = +1\cdot 58$, $z = +12° 18'$, $x = 9\cdot 98$, and $y = 9\cdot 3$. Hence, $x' = 10\cdot 88 \times \cdot 2130 + 11\cdot 35 \times \cdot 9770 = 2\cdot 32 + 11\cdot 09 = 13\cdot 41$ chains, $y = 10\cdot 88 \times \cdot 977 - 11\cdot 35 \times \cdot 213 = 10\cdot 63 - 2\cdot 42 = 8\cdot 21$ chains. The inclination of a tangent at G, to the tangent F A′, is expressed by $30 \times 2° 52' = 86°$; and therefore the inclination of a tangent at G, to the tangent R X′, is expressed by $86° - 12° 18' = 73° 42'$. The given data by which to compute the position of the new origin B′ by means of (XVIII.), will therefore be X = 13·41, Y = 8·21, and D = 73° 42′; that is, $\propto = 8\cdot 21 \times 1\cdot 334 - 13.41 = 10\cdot 95 - 13\cdot 41 = -2\cdot 46$. The required origin B′, of the new curve B′ G, will therefore be situated 2·46 chains in *advance* of the selected point K;

that is, the length of the new tangent R B′ is 14·46 chains. By (XVII.), Sin. T = $\frac{\cdot 71933}{16\cdot 42} = \cdot 04381$; or, T = 2° 30¾′ = modulus of curvature of the required new curve B′ G.

SCHOLIUM.

When the curves under consideration are *long*, and also embrace portions of circumferences greatly exceeding 20° or 30°, the trigonometrical formulas investigated in the foregoing articles become of the utmost importance in the field. But there are several well known approximative formulas which will sometimes be found useful auxiliaries in the first location of a line where short and frequent curves are introduced; and they will also very often be convenient when certain alterations are proposed in a known line, and a new line is required to be selected by computation. It is therefore the design of the remaining part of the present inquiry to show how those approximative results may be easily deduced from the rigorous formulas already given.

28. By means of (VI.), we have $y = \frac{\text{Sin.}^2 nT}{\text{Sin. } T}$; and therefore the quantity $n^2 \times$ Sin. T will always *exceed* the value of y. Hence, $n^2 \times$ Sin. T will express the value of some ordinate *oblique* to the axis of x.

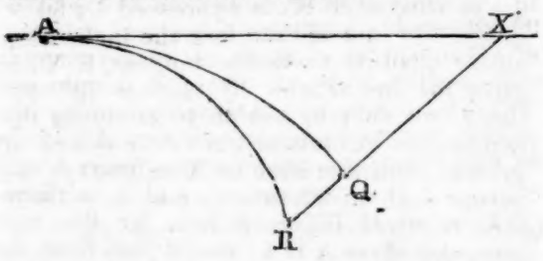
Let this *oblique ordinate* be denoted by K; and the following expression will obtain:

$$K = n^2 \cdot \text{Sin. T.} \quad \text{(XXXVI.)}$$

But by putting $q = 0{\cdot}01745$, which is the length of an arc of one *degree*, to a radius unity, and supposing the angle T to be measured *in degrees, and decimal parts of a degree*, the result will be, that $q \times T =$ Sin. T very nearly. The value of the oblique ordinate K will therefore be nearly expressed as follows:

$$K = qn^2 \text{ T.} \quad \text{(XXXVII.)}$$

29. Suppose T and T′ to denote the respective moduli of curvatures *in degrees* of two curves A Q and A R, which are laid from the same point A, and upon the same tangent line A X; and let each curve contain an equal number of chains represented by n. It is proposed to find an approximate value for the distance Q R.



Let Q X and R X be the two oblique ordinates whose values are expressed by qn^2T, and qn^2T′, respectively. If, then, those two ordinates be supposed to coincide with each other, which will not be far from the truth, then their difference in length must express the required distance Q R. Hence, taking w to represent the line Q R, the following formula is evidently the result:

$$w = qn^2 \cdot (T - T'). \quad \text{(XXXVIII.)}$$

The formula thus obtained is an exceedingly near approximation of the true length of the line Q R, when the curves A Q and A R do not contain more than 20° or 30° each; but its application in the field is confined to that particular case only in which those two curves contain each the same number of chains. And although the length of the line w, as thus computed, will not differ so much from the true quantity as to produce a material inconvenience in the location of a line in a slightly undulating country, even when the two curves embrace portions of circumferences greatly exceeding 20° or 30°, yet, in such cases, if the result were even rigorously true, a knowledge of the *length* of the line w will be of little use in the field when the *obliquity* of that line remains unknown. The formulas (XXIII.) and (XXIV.) must, therefore, in such a case, be resorted to, in order to discover the true position of one of the curves when the other is given; but when those two curves each embrace only a small part of the whole circumference, it will be sufficient in practice to measure the line w as a normal to either curve, in which case the expression (XXXVIII.) will be highly useful.

It is sometimes required to find the modulus of curvature of one of the curves, when the other curve and the line w are given data; in which case the following formula obtains:

$$T' = T \pm \frac{w}{qn^2}. \quad \text{(XXXIX.)}$$

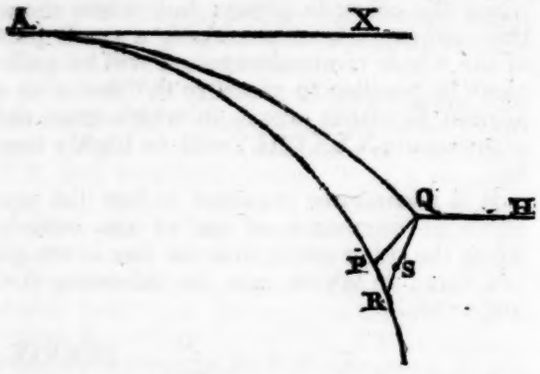
This expression is immediately derived from a transposition of the one preceding.

Three examples will be now given, the first of which will be a case where the formula (XXXVIII.) is not at all applicable; the second will explain a case where that formula can not be used alone with advantage; and the third will show an instance in which the same formula will be very useful in the field.

Example 1. Let a curve whose modulus of curvature is 2° 45′, be traced 20 chains of 100 feet each, from a given point and from a given tangent line. Now it is proposed to lay another curve from the same origin, and from the same tangent line, and whose modulus of curvature is 3°. How far would this latter curve pass from the extremity of the former?

Here, by (XXXVIII.), $w = \cdot01745 \times 400 \times \frac{1}{4}^\circ = 1\cdot75$ chains $= 175$ feet $=$ the required distance as determined by the approximative method. But this result is too far from the truth to be of any practical utility, as will appear from the following accurate calculation. Taking the extremity of the 19th chain for the termination of the new curve, the given data in (XXIII.) are, $n = 20$, $m = 19$, $T = 2^\circ\ 45'$, $T' = 3^\circ$, and $\alpha = 0$; that is, $x = \frac{\text{Sin. } 110^\circ}{2 \text{ Sin. } 2^\circ\ 45'} = \frac{\cdot93969}{\cdot0960} = 9\cdot79$; $y = \frac{1 - \text{Cos.} 110^\circ}{2 \text{ Sin. } 2^\circ 45'} = \frac{1 + \cdot34202}{\cdot0960} = \frac{1\cdot34202}{\cdot0960} = 13\cdot98$; $x' = \frac{\text{Sin. } 114^\circ}{2 \text{ Sin. } 3^\circ} = \frac{\cdot91355}{\cdot1047} = 8\cdot73$; $y' = \frac{1 - \text{Cos. } 114^\circ}{2 \text{ Sin. } 3^\circ} = \frac{1 + \cdot40674}{\cdot1047} = \frac{1\cdot40674}{\cdot1047} = 13\cdot44$; or, $x - x' = 1\cdot06$, and, $y - y' = 0\cdot54$. Hence, $w = (\overline{1.06}|^2 + \overline{\cdot54}|^2)^{\frac{1}{2}} = (1\cdot1236 + \cdot2916)^{\frac{1}{2}} = \sqrt{1\cdot415} = 1\cdot19$ chains $= 119$ feet $=$ true distance from the extremity of the given curve, to the station at the termination of the 19th chain in the proposed curve.

Example 2. Let A R represent the curve of a graded roadway, and suppose A Q to be an approximate curve, traced 10 chains, of



100 feet each, with a modulus of curvature of 2° 45′. From the extremity at Q, suppose a normal line Q P to be measured 40 feet to the centre of the roadway at P. It is proposed to show a method of ascertaining the modulus of curvature which will trace the curve A R.

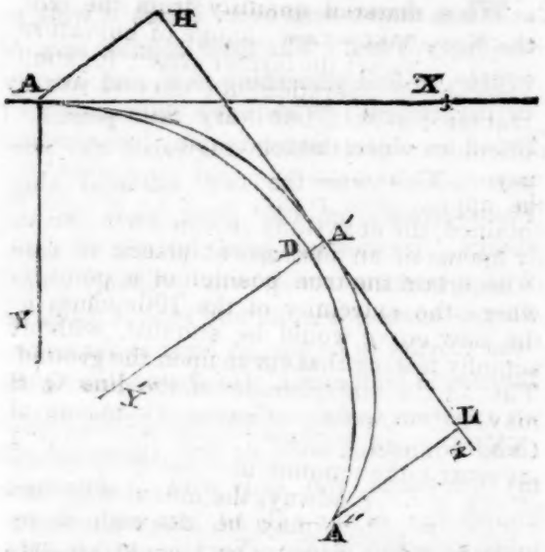
In order to obtain an approximate value for the new modulus of curvature by means of (XXXIX.), the given data are, $T = 2^\circ\ 45'$, $n = 10$, and $w = \cdot4$; that is, $T' = 2^\circ\ 45' + \frac{\cdot4}{\cdot0175 \times 100} = 2^\circ\ 45' + \frac{\cdot4}{1\cdot75} = 2^\circ\ 45' + \cdot229^\circ = 2^\circ\ 45' + 13\frac{3}{4}' = 2^\circ\ 58\frac{3}{4}'$. Now, if a new curve were to be commenced at the origin A, and traced agreeably to the modulus of curvature $2^\circ\ 58\frac{3}{4}'$, it would not touch the point P by a deviation of about 3 feet, as an accurate calculation will show, and a variation of even 6 inches from the true centre of a graded surface is frequently a matter of some consequence. If a small error be made in the modulus of curvature at the commencement of a curve, it is not a proper remedy, after the line begins to deviate a material quantity from the true centre, to make a new change of curvature merely to correct the former error; for such a method of operation not only shows a great want of skill, but it also multiplies the difficulties when the road at any future time may want adjustment. When, therefore, the approximate result, $2^\circ\ 58\frac{3}{4}'$, has been obtained, the next thing required to be done, by means of an instrument placed at Q, is to ascertain the true position of a point S, where the extremity of the 10th chain in the new curve would be situated, without actually tracing that curve upon the ground. The length and position of the line Q S may be correctly computed by means of (XXIII.), and (XXIV.); and then having measured the amount of error S R, to the centre of the roadway, the modulus of curvature required may be determined by means of (XXXIX.) For the given data will then be $T = 2^\circ\ 58\frac{3}{4}'$, $n = 10$, and $w =$ measured distance S R.

It will be here easily observed that there are two sources of error in the first result obtained from (XXXIX.) The greatest part of this error arises from the want of coincidence in the directions of the lines Q P and Q S; for an accurate calculation will show that in the present example, a difference of $13\frac{3}{4}'$ in the moduli of curvatures corresponds accurately with a distance of 39 feet between the two extremities of the curves, which agrees with the distance supposed in the first calculation, within one foot. But owing to the obliquity of the line Q S, a new curve laid from the origin A, agreeably to the modulus of curvature $2^\circ\ 58\frac{3}{4}'$, would intersect the line Q P at about 37 feet from the point Q, and therefore pass 3 feet from the true centre of the roadway.

Example 3. Suppose A A′ and A′ A″ to represent two different curves, connected together upon a common tangent at the point A′, and selected in the field by tracing systems of rectangular lines agreeably to the method of co-ordinate axes as explained in art. 17; and let the *numerical values* of all the quantities remain as in the example given for that article. Now, in the place of these two curves, it is proposed to lay one continuous curvature from A to A″, if the ground about the intermediate point A′ will permit such an alteration; and it is therefore required to know how far the new proposed curve A D A″ would pass from the point A′.

It is very evident that the co-ordinates

A″ H, H A, of the point A, taken with reference to the axes A′ X′, A′ Y′, are respectively equal to the co-ordinates x, y, of the point A′, taken with reference to the axes A X, A Y. Hence, the given data for computing the modulus of curvature of the proposed curve A D A″, by means of (XXII.), are the following: $\propto$ = A′ H = 20·21 chains, β = — H A = — 12·47 chains, x 17·18 chains, y = 10·24 chains, and z = — 63° 20′. Therefore, Sin. T′ = — 2·23 × Cos. 63° 20′ + 37·39 × Sin. 63° 20′



$$-\overline{2{\cdot}23}|^2+\overline{37{\cdot}39}|^2$$

$$=\frac{32{\cdot}412}{1403}={\cdot}02310;$$ or, T′ = 1° 20′ = modulus of curvature which would trace the continuous curve A D A″.

The data for computing the distance A′ D by means of (XXXVIII.), will now be, n = 25, T = 1° 16′, and T′ = 1° 20′; that is, w = ·0175 × 625 × $\frac{4}{60}$ = 0·75 = the required distance A′ D nearly, expressed in chains.

30. When two curves, having their respective moduli of curvatures represented in degrees by T and T′, are laid from different origins upon the same tangent line, let $\propto$ denote the number of chains between the origins. If, then, the curve T be continued n chains, and the curve T′ be supposed to contain $n \pm \propto$ chains, it is evident that the following formula will obtain for a reason similar to that in the preceding article, the quantity w denoting the same line as before:

$$w = qn^2\,\mathrm{T} - q\cdot\overline{n\pm\propto}|^2\cdot\mathrm{T}'. \qquad \text{(XL.)}$$

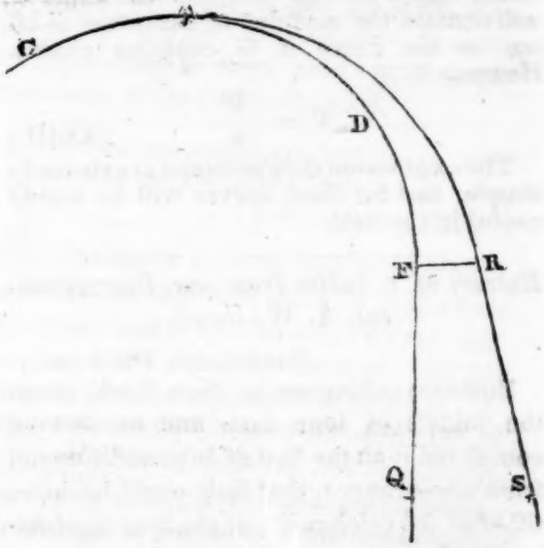
The expression thus obtained will be frequently useful in the field when *short curves* only are under consideration; and if it be supposed that $w = 0$, a formula may obviously be easily deduced which will correspond to (XIX.) by an approximation. For then $n^2\mathrm{T} = \overline{n\pm\propto}|^2\cdot\mathrm{T}'$; that is,

$$\mathrm{T}' = \mathrm{T}\times\left|\frac{n}{n\pm\propto}\right|^2. \qquad \text{(XLI.)}$$

This expression is remarkably simple, and will be very convenient for short curves.

31. Let C A D F represent a given curve, whose modulus of curvature is denoted in degrees by T, and let it pass into a tangent F Q at any given station F. Let also F R represent any small distance immediately on the right or left of the station F, and R S a straight line, whose inclination to the line F Q is denoted by a given quantity z°. It is then proposed to determine a point A in the given curve C A D F, and the requisite change of curvature at A, in order to lay the curve A D F into the position A R, and the tangent F Q into the position R S.

Take w to represent the small given distance F R, and let n denote the required number of chains from A to F, and T′ the required modulus of curvature of the new curve A R.



The two equations, $z = 2n\cdot(\mathrm{T}-\mathrm{T}')$, and $w = qn^2\cdot(\mathrm{T}-\mathrm{T}')$, are furnished by means of (V.) and (XXXVIII.) respectively; and therefore, by eliminating n and T—T′, the following expressions will result:

$$n = \frac{2w}{qz}$$

$$\mathrm{T}-\mathrm{T}' = \frac{qz^2}{4w} \qquad \text{(XLII.)}$$

These formulas will be very convenient in the field when two short curves in reversion are to be connected by means of an intervening tangent common to both curves.

32. Suppose A X to represent a given

tangent line, and A a given point therein, which is designed for the origin of a certain required curve to be laid passing through a given point G. Suppose, also, that the point G is visible from the origin A, and that the approximate distance A G is known. It is then proposed to find the necessary modulus of curvature, in order to trace the required curve A G.

By means of an instrument placed at the origin A, let the angle X A G be measured, and let its value be denoted by D'. It evidently appears from (II.) that the angle D' will contain the modulus of curvature as often as the curve A G contains chains. Hence,

$$T = \frac{D'}{n} \qquad \text{(XLIII.)}$$

The expression thus obtained is extremely simple, and for short curves will be highly useful in the field.

Extract of a Letter from our Correspondent, A. W., dated,

Lansingburgh, 27th August.

Business calling me to New-York, about the middle of June last, and not having completed it on the first of July, and finding, from appearances, that little could be done, till after the celebration of the Fourth of July, I took the opportunity to make an excursion of two or three days to Philadelphia.

Stepping on board the morning six o'clock boat, I was enabled, by a rapid, but pleasing and changeful travel, by land and water, to reach Philadelphia in time for dinner at the United States Hotel. Some people live to eat, and others eat to live; and as I belong to the latter class, I did not pounce my eye on the preparations for dinner in the spirit of a *gourmand*. I merely noticed the profusion of viands on the table, but I could not help, being a stranger, observing the superiority in good, wholesome, well-baked bread, fresh vegetables, and choice butter.

When dinner was over, I took a walk to the Navy Yard. The first impulse was, of course, to find something new, and worthy of inspection. With very little search, I found an object which answered the purpose. This was the new national ship, Pennsylvania, of 140 guns, now on the stocks. It was my good fortune to meet with a gentleman who was probably an officer of some grade, at any rate, I think he was worthy to be one, at least as far as politeness is concerned. He showed me, with an apparent feeling of national pride, every thing connected with it, and answered all my questions, not only with a thorough knowledge of the subject, but with seemingly as much pleasure as I could possibly take in asking them. I took minutes from some of his answers, and among the principal ones I find the extreme length of the ship is 217 feet, its greatest breadth 59 feet, and its depth, amidships, 51 feet. But as naval architecture is not my object, though I took several other notes, I will not tax the printer nor the reader with them. As I had another use for the remaining part of the afternoon, I took a rather painful leave of my interesting guide, reflecting, at the same time, with what wonderful accuracy the sweet and bitter of life are balanced; for the extreme pleasure I took with this momentary acquaintance, was exactly balanced by the pain of parting.

I now steered my course to Washington Square, a fine specimen of taste and liberality. It is situated in the southeasterly part of the city, and I was told that it contains about eight acres. It is beautifully laid out, and planted with ornamental trees, selected from various parts of the world, but, as they should be, mostly natives of our own continent; for certainly, while the Eastern Continent can boast of its ancient ruins, its broken columns, and relics of the arts of other days, now trodden under foot, and crumbling into dust, the proper field, in which to search for the beauties of nature, and to explore her inmost recesses, will be

found in the forests of America. The sun was now descending far in the west, and its light striking in bold relief on the trees and flowers, and reflected from different shades of green, presented a scene beautiful beyond description.

The city contains several other spacious and beautiful squares, but I had not time to visit them. Why is it that our other cities and villages are destitute of these delightful appendages? No reason can be given, but that they were laid out, as we know was the case in the early settlement in our own State, without any plan at all, or the ground has been seized on, and sold in speculation, to gratify the sordid views of forestallers.

> When thirst of gold enslaves the mind,
> And selfish views alone bear sway,

every nobler feeling—every spark of laudable national pride vanishes, as colors vanish when light is withdrawn.

The dusk of evenlng was closing around me, and I returned to my lodgings. The day's exercise had given me an appetite for a wholesome supper, and a night of quiet repose, both of which were duly enjoyed.

At daylight next morning, I took a stroll through the market, and was soon convinced that its celebrity was justly merited. The building and accommodations were in themselves highly worthy of notice. Stretched nearly a mile in length, through the middle of a wide avenve, which is a great thoroughfare through the centre of the city, from one river to the other; and forming, on each side of it, a street of convenient width. Its plan, for beauty and convenience, could scarcely be improved. But to give an idea of the contents of this market, all I can say, from so short an inspection is, it contains samples of every thing which ever was, or can be exhibited for sale in a public market. The meats in general were fine, but the mutton, in particular, surpassed any display of that article I have ever seen. The butter was exhibited in a style of neatness and taste, which would draw tears of pleasure in the eyes of an Epicure. But it was not these more prominent articles only which attracted attention; every thing the eye could recognize, animal, vegetable, mineral, or fossil—natural or artificial, was there, and all so tastefully arranged, that the smallest article seemed to say, examine me too; while the choice fruits, flowers, and fresh vegetables, whispered, with more conscious dignity, here you may see the effect of liberal premiums from the Pennsylvania Horticultural Society.

After breakfast, taking all the rest of the day before me, I set out to view the gardens, water-works, &c.; and, taking a hackney coach, my first course was steered to Bartram's Garden and Nursery. These are situated on the west bank of the Schuylkill, about three miles from the city, and are now owned, and judiciously managed, by Mr. Robert Carr, the son-in-law of Mr. Bartram, who is well known as a botanist and naturalist; and his very superior collection of North American trees and plants, show him in the very pleasing light of being truly national.

On a stone over one entrance to the house, I noticed the date of 1731, rather roughly but plainly cut. On inquiring, I found that this front of the mansion was built at that period; and another inscription, purporting to have been cut 39 years afterwards, reads and spells thus:

> "It is god alone almyty lord
> The holy one by me adored.
>
> "JOHN BARTRAM, 1770."

The garden, it is said, was commenced about four years before the date of the first inscription, and is now about 114 years old. I was informed that Mr. Bartram and his son must have been about 100 years in collecting this valuable legacy they have left to the Flora of North America. A small strip of land, containing less than seven acres, was said to contain rising 2,000 species, natives of our own country. But I found also a no less rich treat in examining the exotics, which were very numerous and valuable. The collection of Camillas and tropical plants, surpassed any thing of the kind I had ever seen; among the latter were some fine specimens of Zamias, Ficus, Euphorbia Hetirophylla, &c. The grounds were tastefully laid out, and besides the amazing variety of smaller trees and shrubs, arrang-

ed, apparently, to the best possible advantage, the effect is still heightened by the grandeur of several trees, majestically towering above, and overspreading the rest: among which are a Norway Spruce, at least 80 feet high; a Cypress, (*Cupressus disticha,*) 25 feet 6 inches in circumference, and 114 feet high; native Magnolias, Flowering Acacias, &c. And beneath this lofty display of variegated foliage, on proper fixtures, I noticed a magnificent Sago Palm, the circumference of its foliage 24 feet, and the stem 3½ feet. But it is vain to attempt enumeration, when the bare catalogue would four times exceed my limits.

Between this beautiful and magnificent grove and the Schuylkill, are several fish-ponds, with gold and silver fish and acquatic plants; and still farther on, towards the river, is an ancient cider-mill, cut, with great labor, out of the solid rock, near which was a small plot of Gama grass. From the numerous accounts of the productiveness of this grass at the south, particularly in North and South Carolina, it must be found a good substitute for clover, herds grass, &c. &c., and its introduction of great importance to that section of our republic. But from an examination with some of it, raised in my garden, and also the opinion of Mr. Carr, who has had it on his grounds a dozen years, I am led to conclude it will be of no great value to our northern farmers. The vines and fruit nurseries were extensive, and appeared in perfect keeping with the rest of this splendid establishment.

Nor was this display of nature more pleasing than the polite attention of its worthy proprietor, who not only answered, with apparent pleasure, all my questions, which, to say the least, extended to the utmost bounds of civility, but showed me many deeply interesting curiosities, and, among other things, his extensive and valuable library, principally on Agriculture, Horticulture, and Botany, which seemed to say,

"Come, let me make a sunny realm around thee,
Of thought and beauty! Here are books and flowers."

Leaving this place with reluctance, I steered my course to Lemon Hill, which is the name very appropriately given to the pleasure grounds of Mr. Henry Pratt. It is situated in the immediate vicinity of the grand Water-works, and is said to contain over twenty acres. Nature seems to have displayed her utmost power in modelling this charming situation, leaving but little for art to accomplish, to render it one of the most delightful spots on earth; and art, with such a bold and lovely model, appears to have availed herself of every advantage, to beautify and complete what Nature had so happily begun.

The mansion is placed on an eminence, commanding a delightful view of the Schuylkill, just at that point where every thing is in pleasant motion. The busy neighborhood of Fairmount, the interesting views of this fine landscape, are fully kept before the eye, by gently winding paths, through a rich and well kept grass plot; every turn producing some new and pleasing effect. The foot does not tread in the same path which the eye has gone over before. The groups of lofty trees, so advantageously placed on the hill, near the house, with their deep green foliage, form a beautiful contrast with those of more light and stinted growth, situated in front of the ground bordering on the water; thereby adding much to the effect, by seeming to remove the perspective to the farthest extremity of the picture. The numerous well stocked fish-ponds, with their islands and aquatic productions, summer-houses, gardens, porters' and laborers' lodges, all well placed for picturesque effect; and the beautiful little grotto, thrown so chastely over the mineral spring, all conspire to complete the beauty and variety, without, in the least, marring the productions of nature, so very interesting in the immediate vicinity. The spacious green hot houses, with their numerous and lovely tenants, spread far and wide in every direction, making the whole garden a repository of flowers and fragrance, certainly stand prominent in their kind; and as we migrate along the well kept gravel walks, so richly adorned by tree, shrub, and plant, of every shade and shape, and from every climate, intermixed with the inmates of the green house, the shaddock, orange, citron,

lime, the fig tree, laden with inviting fruit; the sugar cane, pepper tree, banana, guava, and plantain; the cheremalia, mango, and splendid cactus; a reflecting mind must be lost in admiration, not knowing which most to admire, the amazing variety produced by nature, or the wealth, liberality, and taste, which have planted and sustain them there.

As I cast a valedictory glance at this enchanting scenery, the power of association brought forcibly to my mind the sligthed and neglected talents of my worthy friend Perrine, whose whole soul is compounded of botanical science and horticultural taste. Had the magnanimity of our wise National Legislature been sufficient to have granted his petition, for a few acres of wild, and, probably for a long time to come, worthless land, on the peninsula of Florida, and the little pecuniary aid, to which every sensible man in the nation would have been proud of contributing, to enable him to establish a national repository, for the introduction and acclimation of exotic plants, he would ere now have exhibited all the beauties and rich treasures of the vegetable world, flourishing in high exuberance, without the expensive aid of artificial heat. One half of the amount, which the patriotic and noble spirited proprietor of this establishment has expended, from his own purse, would have accomplished his object in a manner highly creditable to the nation, and profitable to the present and future generations. But public bodies, like corporate bodies, have no souls.

But I found the plan of my pleasing excursion, as I now find that of my letter, extended beyond the bounds to which circumstances limit its accomplishment; and I had then, as I have now, to quit the subject almost at the beginning. You know my attachment to the subject of horticulture, and you know there is nothing else so pleasing to me, except the cultivation of the human mind. But here I had both the subjects before me; one, in the situation I have so faintly described, and the other, in the more than pleasing urbanity and politeness of its proprietor, either of which, to say the least, I never saw excelled. I have ever been of the opinion, that a spirit to relish, and taste to direct horticultural improvements, is commensurately an evidence of an amiable and philanthropic disposition; and, if proof were wanting, I found it amply displayed, in the kind attention, which, as a stranger, I received, not only from Mr. Pratt, but from his principal gardener.

The day was now far spent, and I had only time to take a slight glance at the water-works. As I am not familiar with the subject of mechanics, and if I were, I had now no time for

> "Examining with care each wondrous matter
> That brought up water."

I can only say, of the whole, it is a stupendous establishment. But there was a peculiar charm to me in the reservoir on the hill, consisting of three beautiful sheets of water, and a fourth in operation.

The time I had allotted for my stay was nearly exhausted, and I had examined but two of the gardens, of which I had procured a long list. I had promised myself the pleasure of visiting Mr. Parker's Botanic Garden, Mr. McArran's Botanic Garden and Nursery, Mr. Hibbert's Nursery, Messrs. Landreths' Nursery, and others of equal celebrity; but the imperious call of business compelled me to forego the pleasure, and it being now Saturday night, I returned to my lodgings.

On Sunday morning I attended Church. But in the afternoon, as an exercise not altogether unapropriate for the day, I visited Rolinsan Rural Cemetery. This is a place which, though no person of common sense could leisurely enter with feelings of levity, yet no reflecting mind could spend a few moment's contemplation in it, without experiencing emotions of exquisitely pleasing satisfaction, though still partaking of a sober seriousness nearly bordering on melancholy.

This place contains 2½ acres. It was commenced in 1827, and now contains between 4 and 5000 interments, and about 100 vaults. When it was first commenced a lot about 10 by 8 feet sold for $40, but will now command from $90 to $100. An adult stranger can be buried for $8, and a

child for $4, including opening and closing the grave.

The place is inclosed on three sides with a handsome stone wall, and the front side with an iron railing. On the right hand of the entrance is a dwelling for the attendants to the concern, where they are at all times to be found. On the left is a green house, with rooms over it for meetings of the lot-holders and managers.

The plants in the green house are for the purpose of ornamenting graves, at proper seasons; and hardy flowers in great variety are growing, tastefully and liberally scattered over the ground.

Among the various and numerous monuments, some were of peculiar elegance. I noticed one, on which the incription stated that it was executed in Italy. It was of exquisite material and workmanship, and I could not help admiring the skill in the fine arts peculiar to that country; but looking a little farther, I was most agreeably astonished to find one executed in Philadelphia, quite surpassing it; I could not but indulge some feelings of pride in reflecting on the amazing improvement since 30 years ago, when similar monuments were ornamented with an awful staring death's head and marrow bones.

Among the interments I noticed that of a Chinese, aged 37, buried in 1830. Part of the inscription was in the Chinese character.

I could not view this interesting spot without painful reflections, on what appears to me the unpardonable want of similar institutions in the great and opulent State in which I live. Can it be from a want of social affection in the people in this state, or can it be from feelings of parsomony, that we grudge the expense, that we suffer our friends to be put under the turf to-day, and the place of their rest broken up and perhaps appropriated to some other use to-morrow? The Corporation of your city are selected for their supposed fitness, and are duly authorised and empowered to manage and direct all affairs of public interest; and is it not a duty they owe to protect the public feelings, from what must be daily suffered by persons who cherish with tender affection the memory of their deceased friend, when they see the place of their remains turned into a common highway, or perhaps dug up, and their bones scattered and trodden into dust?

This is naturally a public concern; but if it does not soon receive the attention the importance of the case demands, it will pass into the hands of private speculation, from which it would be difficult to return it to its proper channel, and which would place it in a state truly to be deplored by every person whose heart is warmed by a spark of philathropy or patriotism. But to return.

On Monday morning I left Philadelphia, and I can truly say, I never spent three days in more pleasing gratification. Getting on board the steamboat, I lost much of the beauty of the scenery on the way to Trenton, by accidentally taking up part of a number which I had not seen before, of a new and beautiful little periodical entitled the Zodiac: it so completely engrossed my attention, that I saw nothing else till I had finished perusing it, just as we arrived at Trenton.

As natural history is in some measure my hobby, of course my attention was particularly occupied by the *Naturalist's* book, in which I was confident I recognized the pen of my esteemed friend Doct. ——, and I determined to patronize the Zodiac at my return.

A. W.

[For the Mechanics' Magazine.]

TO OUR AGRICULTURALISTS.

Foreigners, the least conversant with the grades of society in Europe, are much surprised at the low social estimation of the agriculturalists of this country. In every part of the civilized world, excepting this, they are ranked among the foremost in public opinion; here, every petty shopkeeper is considered their superior. There are many exceptions to this rule, but as a class it will be admitted to be correct.

There must be something radically wrong in the self-estimation of our farmers, or such an inverted state of their esteemed condition could not exist. To endeavor to induce them to make a fair estimate of

themselves, is the object of this essay. I will attempt to show them why, as a class, they ought to rank at least as high as any other, and then point out to them why they now rank so much lower in public opinion than those of the same class in other countries. I have no wish to increase their pride, for man has nothing to be proud of; besides, pride, as the term is generally understood, is a mean, grovelling quality, exactly adverse to a fair appreciation of ourselves in oursocial capacity.

The fact, that the cultivators of the soil are the primary producers of the whole wealth of a country, is of itself sufficient proof of their superiority as a class. This fact will no doubt be denied by many of our dealers and shopmen, who are incapable of tracing effects to causes, and who, wrapt in self-conceit, have assumed a station that does not belong to them. The fact, however, can be easily demonstrated, which I shall endeavor to do in as succinct and plain a manner as possible.

We have about two millions of families, including farm laborers, employed in agricultural and horticultural pursuits. This estimate may be considered excessive, for there may be less than two thirds of our whole population engaged in cultivating the soil; but however much beyond the reality, it alters the conclusion to be drawn from the premises only in diminishing the amount put in circulation annually, not in its inductive facts. We will suppose that the land under cultivation affords no surplus beyond the support, in the first necessaries of life, to those employed in cultivating it. It is evident, in this case, that the farmers having nothing to sell, would be unable to purchase any thing; that every individual of our population would be compelled to cultivate the soil to obtain an existence, for there would be neither sellers nor purchasers. We will further suppose that the average surplus of each family, beyond their own existence, to be fifty dollars per annum, and that the whole of this were wanting to supply agricultural instruments. The amount to be expended would now be one hundred millions of dollars per annum, which would put into operation a given number of workmen in wood and iron, as well as a small number of dealers to facilitate the receiving and executing of orders. Trade has now commenced, but never could have started but for the farmers' surplus. If the average surplus of each agricultural family should be one thousand dollars, an estimate probably very near the truth, and the greater portion of this surplus be expended in the usual variety of objects which go to promote the comfort and luxury of families, it is evident, that in addition to the workers in wood and iron, there would be put in operation builders, cabinet makers, clothiers, and a thousand other sources of industry.

If, when these agents have accumulated capital, and by this means extended their operations so as to meet the increasing demand of the agriculturalists, shall pride themselves on a factitious superiority, forgetting in toto the source of their wealth, ought they not to be pitied rather than admired by the intelligent part of community?

The amount put in circulation by our farmers, on the last estimate, would be two thousand millions of dollars per annum, and the number of workmen and agents employed to execute orders would be vastly increased. The whole capital accumulated by the country is exactly the amount saved out of this surplus, by the farmers, and the agents and workmen employed by them.

That our farmers should have a surplus of two thousand millions of dollars per annum, over and above feeding their families, would appear, at first sight, to be much overrated; but after deducting four hundred millions for the wages of workmen, and three hundred for buying and planting new farms, building houses and barns, buying new instruments of agriculture and repairing old ones, we shall find that it leaves but about eighty-five dollars per head for our whole population for clothing, furnishing, and other necessaries and comforts sought by those who can afford to purchase them. It should also be recollected that five millions of our population derive all their necessaries, comforts, and luxuries, from this surplus, and that the annual accumulation of capital is a product of that excess.

So long as there is land in a country of first and second rate qualities, for the creation of new farms, so long can this primary source of wealth be extended. There is also ample room in this country for a great extension from the land now under cultivation, as at least one third more product could be raised from it than is now

produced; but as this consummation cannot possibly take place until interest of money and wages are lower, or new labor saving machines shall be invented, we must hope rather than expect to see it realized in our day.

Manufacturers, dealers, and shopmen, and, in fact, all who are not laboring on farms, derive their whole support from this agricultural surplus. The capital, accumulated by those agents who buy and sell, whether merchants, shopkeepers, or dealers in any commodity, being savings from the varied circulation of said product, the farmers ought surely to be entitled to their highest consideration.

This surplus is by no means stationary, and the prosperity of some years, as well as the depression of others, are the results, in the greater number of instances, of the greater or smaller surpluses. If the surplus one year should be twelve hundred millions of dollars, another seventeen hundred millions, and another twenty-two hundred, it would be easy to account for the elevations and depressions in the business community of the country. In fact, the variations which annually take place in these surpluses is the only true barometer of a country's prosperity.

When merchants, manufaturers, and dealers in a country are operating with large masses of capital, the accumulation of many years, concentrated in cities and towns, they lose sight altogether of the original source of wealth. And where the right of primogeniture does not exist, as in this country, to enable agriculturalists to concentrate their property in the heads o families, the other classes will, apparently, be much richer, and claim a superiority. Their riches, however, is only *apparent;* for the far greater portion of wealth in every country must ever remain with the owners of the soil. Much of the capital wielded by dealers is altogether fictitious, being predicated on credit, and a considerable share of their more solid capital is borrowed from the savings of property owners.

Let me ask our farmers why it is, with so many solid claims to superiority, that as a class they tacitly acknowledge themselves inferior to those who are their dependents? I need bring forward but one circumstance to prove the fact. When our farmers have a son they consider more than usually talented, do they not bestow a better education on him, with a view to settle him with some merchant or dealer in our cities or towns, and this with the fearful odds against them of his being ruined in pocket, mind, and body, as is the fatal issue with three fourths of the whole number? This is plainly acknowledging that it requires more talent and a better education to make a dealer and shopman than it does to make a farmer, and this depreciated view of their own condition is the main cause of their being undervalued by the community in general.

There is no business or profession, in the whole circle of human pursuits, that requires more solid talent to execute well than that of cultivating the soil, and there is no class of our citizens whose education is so generally neglected. It is too generally considered that to learn to plough, harrow, sow, drill, and plant; to harvest well when crops are ripe, and sell when ready for market, are all the qualities necessary for a farmer, with the addition of a little cyphering and writing. These, it is true, are necessary qualifications for every man who has the management of a farm; but they are by no means all that are requisite to make the pursuit yield its greatest degree of profit, and sufficiently interesting to attach the most enterprising and talented of its sons to the calling. If the owners of the soil are desirous of acquiring wealth, and at the same time that degree of respectability which will make them respect themselves as a class, they must acquire far more knowledge than the mere drudgery of a farm. They should know practically how to perform every branch of labor, in order to understand when their workmen do them justice; but the pursuit must indeed be miserably unproductive and uninviting if the owner of the estate cannot make more by systematizing his business, and superintending the carrying out of the system, than by personal labor. They should understand mensuration sufficiently to be able to calculate the quantity of land after the chain has been run; the advantages of draining, with the most effective and most economical way of operating; the properties of different soils, including a knowledge of what seeds and plants are most productive in each, with a critical judgment of the manures or composts best adapted to different qualities of soil; suffi-

cient of botany to enable them to judge of seeds, plants, and fruit trees, with the best mode of producing them in the greatest abundance and in the highest degree of perfection.

It will not be denied that to acquire such knowledge would be highly advantageous to our agriculturalists, and not only to them as a class, but to the general community, for the average of the farming surplus would become so much larger as to materially benefit the whole mass. But, say they, how is this knowledge to be acquired? neither our common schools, academies, nor colleges, give any such instruction, therefore we have not the means of acquiring it. This objection is too true, and is a truth highly disgraceful to the enlightened age in which we live. The means of acquiring an agricultural education ought immediately to be put within the reach of this our most valuable class of citizens. In every college there are professorships for physic, law, and divinity, but none for that class on which our prosperity and very existence depends. Agricultural schools, academies, and colleges, with experimental farms attached to each, and with such professors as are requisite for the scientific departments, cannot be too soon established. The expense of such establishments would be repaid a hundred fold during the existence of the rising generation. A farmer should learn arithmetic, mensuration, agricultural chemistry, mineralogy, geology, and the physiology of seeds, plants, trees, and animals. A certain portion of his time should be appropriated to acquiring scientific knowledge, the remainder to practical operations of scientific principles. The expense of such an education should be as moderate as possible, particularly in the commencement so low, as to induce those who have but little to spare for education, to send their sons to such establishments, in preference to any others, on the score of expense alone.

With such an education, our farmers, instead of looking to other pursuits for their most talented sons, would feel it a degradation to place them any where but on the soil. Their sons, too, finding agriculture the most exalted of human employments, would be proud of their calling. That time of the year in which they are most unemployed, in place of hanging heavy on their hands, would be appropriated to improving their minds. They would as a class stand boldly prominent in the front ranks of society, and instead of any feeling of inferiority, as is now too much the case, would be able justly to consider themselves on a perfect equality with the best of any class; and that ignorant flippancy they now so much admire in others, would be found hollow and disgustingly nauseous. Politically they would become truly independent, and in place of being the tools of designing political knaves, they would have intelligence to enable them to think justly on every political subject, and manhood to back their opinion. But the most exalted of all considerations would be the effect on their moral condition individually. They would not only be able to appreciate themselves and their pursuit fairly, as a class of the human family, but in the investigation of the wonderful arrangement in the order of nature, they would feel that man was a being of exceedingly limited powers, that his utmost scope was as nothing in the presence of Him whose infinite mind had arranged, and whose infinite power had executed the wonderful works of creation. In possession of a physiological knowledge of the construction of seeds, plants, and trees, with the adaptation of soils to their growth and maturity, their contemplations would open to them a nearer approximation to the Divine Mind, and whether in the field or their chambers, they would enjoy this greatest and most durable of all sources of human happiness, that they were never "less alone than when alone." W. P.

W. P. will not leave the subject, we trust, which he seems so well to understand, with a single communication. Our columns will always be open to such communications.—[Prop. N. Y. F.]

Croton River.—We perceive by a statement in the Daily Advertiser, that the Water Commissioners have requested Mr. Douglass, Chief Engineer of the New-York Water Works, to make a gauge of Croton River in its present state, which has been done accordingly. The result is communicated to the Chairman of the Commissioners, Hon. Stephen Allen, in the following terms:

Sing Sing, 6th October, 1835.

Dear Sir:—It being a rainy day, I have completed my calculations relative to the supply of water in the Croton, and lose no time in sending you the result.

The gauging was performed yesterday (Monday) morning, before the flow had been increased by the working of the Mills above, and probably exhibited the very lowest rate of discharge which has been experienced this season, in consequence of the water having been generally shut back in the ponds during Sunday.

I confess I was somewhat alarmed by the appearance of the stream—it was drawn into so *narrow* a channel, leaving wide margins of its slimy bed, which had rarely, if ever, been uncovered before, and which had evidently been under water the day previous, now *uncovered*—and the stake which I had driven at the former gauging, standing high and dry at a considerable distance from the water's edge. I proceeded with my work, however, and gauged the water, even in this reduced state, with extreme care, and found the result as follows:—

Section of water equal 40 1-2 square feet.

Mean velocity per second 97-100ths of a foot.

Giving for the discharge per second 39 28-100ths cubic feet.

And per day 3,393,792 *cubic feet.*

Which is equal to 21,133,324 standard gallons.

The gauging was performed near Pine's Bridge, and of course did not include Flewwelling's Mill Streams, and several other runs which were found unfailing, and which discharge their waters above the dam. The first mentioned, being the most considerable, were gauged, (two of them,) and found to yield jointly 744,326 gallons, which being added to the preceding result, gives an aggregate of 21,877,650 gallons*—the smaller runs referred to not being included.

I thought it desirable to obtain this result, as being the minimum flow under the most *unfavorable* circumstances; it evidently ought not, however, to be considered as the discharge of any one entire day. The waters had been stopped back on the Saturday night previous, and the stream at the instant of gauging, appeared to be under the full effective influence of this stoppage—probably a few hours would again restore it to its customary height. To verify this fact, one of the party was left behind for the purpose of taking the height of water, by a certain mark, frequently during the next following 24 hours, and the following were the results: at 5 P. M. of the same day, the water had risen 1 7-8 inches, at 9 in the evening *no further change* either way; during the night a storm commenced and continued raining in the morning, so that the rise of water was considerably influenced thereby.—The measurement at 7 A. M. on this morning, for instance, gave a rise of 4 3-8 inches, and at 10 a rise of 7 7-8 inches above the level at the hour of gauging—and there now is, therefore, probably more than a hundred millions of gallons running, from the joint effect of rain and *diurnal* increase.—To avoid any error in estimating the effect of *rain*, I *exclude* the observations of this morning, and deduce my *average daily* supply from the *result of the gauge*, and the *notes of last evening*. These carefully calculated gave 27,954,790 standard gallons; and this, under all circumstances, I consider as the *lowest daily* supply for this year—certainly very much *within bounds*, as I have no doubt from my observation of the stream, that the flow would have been much increased this morning, independently of the rain, and would have given us, could I have ascertained it by an actual measurement, an average considerably higher than that stated.

Having thus deduced what may be considered as the minimum rate of flow at *any one time*, and the minimum *daily supply*, I will just add in connexion, a remark upon the general average of supply, *during the drought*, for this is the real question of interest in relation to the supply of the city

On the seventeenth of August I gauged as heretofore reported, and found between 43 and 44 millions of (wine) gallons flowing. I have since repeated the calculation of my notes with greater care, and find the quantity in standard gallons equal to 39,601,266—from that time to the date of the recent gauging, the river has been falling regularly,—but as it fell towards the last more slowly than at first, and that we may run no risk of *over* estimating, I give *twice* the value in averaging, to the *low* result, that I do to the *high one*, and upon this principle I find the daily discharge for the time mentioned (49 days) equal to 31,836,948 standard gallons.

One other remark—Our Croton reservoir will be 400 acres in extent, and will contain therefore, about 100,000,000 of gallons to each foot of depth at the surface. The disposition of the works at the head gate, will be such as to admit of drawing this *down* if necessary, say 3 1-2 feet (350,000,000) with a residue of *held still* sufficient for the full supply of the conduit—we shall thus have a disposable surplus, for occasions of drought, sufficient, after deducting an ample allowance for evaporation, to afford 5,600,000 gallons per diem for fifty years, and this being added to the preceding average for that time, gives an available aggregate of 37,436,948 gallons per diem.

All these calculations, it will be recollected, are founded upon actual ascertained results, during a season of unparalleled drought—on this point there is no difference of opinion. The counties of Westchester and Putnam, furnish incontestible proof of it, in the multitude of streams and springs every where noticed as having failed this year, which have never been known to fail before; and the Croton itself, according to the concurrent testimony of the inhabitants, has been at the same time *lower* and low for a longer period than is remembered on any former occasion. A result, therefore, obtained under these circumstances may de deemed certain, and should, I think, put the question of supply enterely at rest.

I should not omit to mention that I gauged the water on the same day at the wire factory below Garrittson's Mill, and found it to agree very nearly with the gauging *above*, the pond having been drawn down (evening) and the head gates drawn clear of the water,—the difference was only about about 200,000 gallons. This gauge, however, was less likely to be accurate than that at Pine's bridge, as there was a considerable stream wasting through the dam, which it was difficult to measure accurately, on account of its spreading among the stones. I shall continue to keep an eye upon this subject, should anything further occur worthy of notice.

I remain, yours very truly,

D. B. Douglass.

Chief Engineer N. Y. Water Works.

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* This quantity estimated in Ale gallons is 21,210,433.

And in common wine gallons, 26,266,904.

THE

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Nathaniel Greene had many obstacles to encounter—yet he rose superior to them by his talents, industry, and integrity, and came to be esteemed as one of the ablest Generals who fought during the American revolution.

Nathaniel Greene, a major-general in the army of the United States, and one of the most distinguished officers in the revolutionary war, was born in the town of Warwick, in Rhode Island, in the year 1741. His parents were quakers. His father was a respectable anchor-smith. Being intended for the business his father pursued, young Greene received nothing but a common education. But, to himself, an acquisition so humble and limited was unsatisfactory and mortifying. While he was a boy, he learned the Latin language chiefly by his own industry. Having procured, in part, by his own economy, a small library, he spent his evenings, and all the time he could redeem from business, in regular study. He read with a view to general improvement: but military history occupied a considerable share of his attention, and constituted his delight.

He embarked in his father's line of business, and in the regular pursuit of it, employed a considerable portion of his time, until he was elevated, at an unusually early age, to a seat in the legislature of his native colony. In this situation, the commencement of the revolutionary war found him; and the undisguised part which he took in promoting an appeal to arms, caused him to be dismissed from the society of friends, of which he had antecedently been a member.

He began his military career as a private in a military association, of which he was the principal promoter, and which was chartered under the name of the *Kentish Guards*, and commanded by general James M. Varnum. But in the year 1775, Rhode Island having raised three regiments of militia, amounting in the whole to about sixteen hundred, and officered by some of her most distinguished inhabitants, she placed them under the command of Mr. Greene, with the rank of brigadier-general, who, without loss of time, conducted them to head-quarters, in the village of Cambridge.

Here, having, by a single act of promotion, after a noviciate of about seven months, exchanged the rank of a private for that of a general officer, he soon distinguished himself, in his present station, and offered to others a most salutary example. This he did in a very special manner, and with the happiest effect, by his prompt obedience to the commands of his superiors, at a time when the subordination, which alone can render an army efficient and powerful, was not yet established; by habits of strict and laborious attention, in the regular study of the military science; and by the excellent discipline which he caused to be introduced into his own brigade.

General Greene's merit and abilities, as well in the council as in the field, were not long unnoticed by general Washington, who reposed in him the utmost confidence, and paid a particular deference to his advice and opinion on all occasions of doubt and difficulty.

He was appointed major-general by Congress, the 26th of August, 1776. Towards the close of that year, he was at the Trenton surprise; and, at the beginning of the next, was at the battle of Princeton: two enterprises not more happily planned than judiciously and bravely executed, in both of which he highly distinguished himself, serving his noviciate under the American Fabius.

At the battle of Germantown he commanded the left wing of the American army, and his utmost endeavors were exerted to retrieve the fortune of that day, in which his conduct met with the approbation of the commander-in-chief.

In March, 1778, he was appointed quarter-master-general, which office he accepted under a stipulation that his rank in the army should not be affected by it, and that he should retain his right to command, in

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The following extract from the Biography of General NATHANIEL GREENE exhibits in an eminent degree the success which results from a proper attention, while young, to books; and a well regulated after-life.

Nathaniel Greene had many obstacles to encounter—yet he rose superior to them by his talents, industry, and integrity, and came to be esteemed as one of the ablest Generals who fought during the American revolution.

Nathaniel Greene, a major-general in the army of the United States, and one of the most distinguished officers in the revolutionary war, was born in the town of Warwick, in Rhode Island, in the year 1741. His parents were quakers. His father was a respectable anchor-smith. Being intended for the business his father pursued, young Greene received nothing but a common education. But, to himself, an acquisition so humble and limited was unsatisfactory and mortifying. While he was a boy, he learned the Latin language chiefly by his own industry. Having procured, in part, by his own economy, a small library, he spent his evenings, and all the time he could redeem from business, in regular study. He read with a view to general improvement: but military history occupied a considerable share of his attention, and constituted his delight.

He embarked in his father's line of business, and in the regular pursuit of it, employed a considerable portion of his time, until he was elevated, at an unusually early age, to a seat in the legislature of his native colony. In this situation, the commencement of the revolutionary war found him; and the undisguised part which he took in promoting an appeal to arms, caused him to be dismissed from the society of friends, of which he had antecedently been a member.

He began his military career as a private in a military association, of which he was the principal promoter, and which was chartered under the name of the *Kentish Guards*, and commanded by general James M. Varnum. But in the year 1775, Rhode Island having raised three regiments of militia, amounting in the whole to about sixteen hundred, and officered by some of her most distinguished inhabitants, she placed them under the command of Mr. Greene, with the rank of brigadier-general, who, without loss of time, conducted them to head-quarters, in the village of Cambridge.

Here, having, by a single act of promotion, after a noviciate of about seven months, exchanged the rank of a private for that of a general officer, he soon distinguished himself, in his present station, and offered to others a most salutary example. This he did in a very special manner, and with the happiest effect, by his prompt obedience to the commands of his superiors, at a time when the subordination, which alone can render an army efficient and powerful, was not yet established; by habits of strict and laborious attention, in the regular study of the military science; and by the excellent discipline which he caused to be introduced into his own brigade.

General Greene's merit and abilities, as well in the council as in the field, were not long unnoticed by general Washington, who reposed in him the utmost confidence, and paid a particular deference to his advice and opinion on all occasions of doubt and difficulty.

He was appointed major-general by Congress, the 26th of August, 1776. Towards the close of that year, he was at the Trenton surprise; and, at the beginning of the next, was at the battle of Princeton: two enterprises not more happily planned than judiciously and bravely executed, in both of which he highly distinguished himself, serving his noviciate under the American Fabius.

At the battle of Germantown he commanded the left wing of the American army, and his utmost endeavors were exerted to retrieve the fortune of that day, in which his conduct met with the approbation of the commander-in-chief.

In March, 1778, he was appointed quarter-master-general, which office he accepted under a stipulation that his rank in the army should not be affected by it, and that he should retain his right to command, in

time of action, according to his rank and seniority. This he exercised at the battle of Monmouth, where he commanded the right wing of the army.

It is unnecessary for us to follow him through the perilous period and struggle, in which he acted so conspicuous a part: his history is identified with that of his country, and every American youth should become familiar with that. We desire here to plant a seed, which will become a *tree* of general knowledge in every young man who reads the "Companion"—and therefore close by giving one or two short extracts from the closing part of the biography.

"We will now dismiss the reader with these remarks. *To the young* and the lowly, the incidents of general Greene's life hold out a most valuable moral. They show, with certainty, that there is no condition which may not be improved by virtue and perseverance; that the acquirement of knowledge leads directly to eminence, and that the most persevering labor is not inconsistent with the improvement of the mind, when the mind is steadily bent upon its own improvement. And let no discouraging inferences be drawn from the persecutions which he underwent from envy and detraction. They will fasten on eminence; and to quote the general's own language, 'every one but an idiot will have enemies.' These are among the trials incident to human life, and they will attack those most severely who raise themselves from obscurity, Men cannot bear mortifying comparisons; and, therefore, envy those most who have risen from among themselves. But it is a most consoling evidence, that truth will never be abandoned; that after such a lapse of time, we find the fame of this great and good man vindicated by the production of evidence which cannot be resisted. The plain inference is, that we do our duty, and trust to Providence for the rest." * * * *

Walking out, without his hat, in the afternoon of the 15th of June, 1786, the day being intensely hot, he was suddenly attacked with such a vertigo and prostration of strength, as to be unable to return to his house without assistance. The affection was what is denominated a "stroke of the sun." It was succeeded by fever, accompanied with stupor, delirium, and a disordered stomach. All efforts to subdue it proved fruitless, and it carried him off on the 19th of the same month.

General Greene left behind him a wife and five children.

On Tuesday, the 12th of August, 1786, the United States, in Congress assembled, came to the following resolution:

"That a monument be erected to the memory of Nathaniel Greene, Esq., at the seat of the federal government."

EFFECTS OF INTEMPERANCE.—On my return from church, on Sunday last, I met a well dressed young man, who was so much under the influence of liquor, that he could with difficulty keep on the side-walk. He was well dressed, and but for the effects of *rum*, would have passed for a gentleman. After passing him, and reflecting a moment on his situation, it occurred to me that a few words of advice would not be without good effect, and I returned, with a view of making an effort to benefit him, or at least to persuade him to retire where he would not be the cause of collecting a crowd of boys around him, as is often the case in some parts of the city. Before I came up with him, however, he had reached the corner of a street where a grocery was kept, and open, even on Sunday, and from his conduct I presume he had taken another glass, for he was with a crowd around him, making violent gestures, and threatening to fight any man who interfered with him. I hesitated a moment, whether to attempt to advise him; when, on observing me looking intently at him, he addressed me thus: "*I am a Yankee*, (which I regret to say was true,) and can whip any man who dare lay hands on me." He then took hold of me, and I endeavored to soothe him, and to persuade him to accompany me; but he would not do so, and with all my efforts I could not induce him to leave the place—and I left him.

Thus it is, that many a young man, who leaves his friends and enters this great city to seek his fortune, either from disappointed hopes, or *to great success*, which often destroys young men, destroys himself by a resort to intoxication—when, by *industry*, *sobriety*, and devotion to business, they might become respectable citizens, and men of wealth.

Again we see the effects of intemperance in the *riot* which took place in Chatham street, *on Sunday*, 21st inst.; where hun-

dreds assembled and commenced a general fight in consequence of the acts of one DRUNKEN man—where clothes were torn, faces bruised, and heads broken, in consequence of the intemperance of one man—and from which small cause, twelve or fifteen persons are now in prison, or held to bail. Would it not have been better for that man to have refrained from *rum* on *that* day? Recollect, young man, whenever you put the glass to your mouth, that such things have been caused by rum—and may it not cause you to conduct in the same manner? *Avoid it, as you would a deadly poison.*

FATAL EFFECTS OF GAMING. — The following melancholy account of the effects of *card playing*, should be a warning to those who are in the habit, or accustomed to indulge in the practice of gambling. Many a young man, like this beautiful young lady, has fallen a sacrifice to the arts of designing knaves and villains. The most certain way to avoid such a result is *always* to avoid gambling, of any description.

Miss Frances Braddock was the admiration of every polite circle. Her person was elegant, her face beautiful, and her mind accomplished.

She unhappily spent a season at Bath. The whole *beau monde* courted her acquaintance: she gave the *ton* not only to the fashion, but to the sentiments of every assembly. Her taste was admirable: her wit was brilliant.

Her father, at his death, bequeathed twelve thousand pounds between her and her sister, besides a considerable sum to her brother, the late general Braddock, who was cut off with his party, on an expedition against the French and Indians.

Four years after the death of her father, she lost her sister, by which her fortune was doubled: but alas! in the course of a month, by a constant application to cards, she lost the whole.

She fell under the infatuation of a confidence in her own opinion. She conceived that judgment was sufficient, being totally ignorant of unfair practice.

Her misfortune preyed upon her mind: nor did she communicate the cause, even to her most confidential friends, for a considerable time; till at last her mind being unequal to struggle with accumulating adversity, she declared to an intimate female, that the world should never be sensible of her necessities, however extreme they might be.

Notwithstanding her caution, her poverty became known; and her sensibility was daily injured by the real and fictitious condolence of her acquaintance, which stimulated her to the rash resolve of terminating her anxiety by putting an end to her existence.

On the night of perpetrating the act of suicide, she retired to her chamber, in apparent good health, and in full possession of her senses. Her attendants left her in bed, with a candle lighted, as was usual; and having locked the door, put the key under it.

Miss Braddock had always opened her chamber-door in the morning to admit her attendants: but the next morning, the maid, coming as usual, and not hearing her mistress stir, retired, 'til near two o'clock in the afternoon, when being alarmed at receiving no answer to her calling, she employed a man to climb in at the window, when the horrid catastrophe of her mistress was discovered: and the following fact appeared in the evidence, upon the view of the coroner's inquest.

After the departure of the maid on this night, she got out of bed again, and, as it is supposed, employed some time in reading, as a book was discovered lying upon her dressing-table. She put on a white night-gown, and pinned it over her breast; tied a gold and silver girdle together; and hanged herself on a closet door, in the following manner: at one end of the girdle, she tied three knots, each about an inch asunder, that if one slipped, another might hold—opening the door, she put the knotty end over; and then locked it, to secure the girdle, at the other end of which she made a noose; put it about her neck; and dropping herself off a chair, accomplished her fatal purpose. She hung with her back to the door, and had hold of the key with one of her hands. She bit her tongue through, and had a bruise on her forehead, supposed to have been occasioned by the breaking of a red girdle, on which she had tried the first experiment, and which was afterwards found in her pocket, with a noose upon it. The coroner's inquest being called, they returned their verdict, *non compos mentis*.

On the day after, she was decently buried in the Abbey-church, by the side of her brave old father, who happily did not live to weep over the misfortunes of his children. In her window were found written the following lines:

O death! thou pleasing end to human woe!
Thou cure for life! thou greatest good below!

Still may'st thou fly the coward and the slave,
And thy soft slumbers only bless the brave.

Thus, by an act of self-murder, or of madness, a young lady, in the 23d year of her age, in the full possession of personal charms, sensibility, and virtue, lost her life by an unhappy infatuation to a fashionable vice.

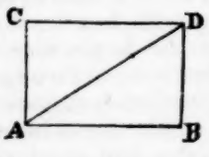
TELESCOPES.—In the county of Worcester, Mass., a self-taught optician resides, who has manufactured some of the best telescopic instruments ever exhibited in this country, so far as it regards distinct vision, under a very high magnifying power. Yet no one patronizes him, to the extent which his merit certainly demands. Every thing within the calibre of his telescopes is complete; and, indeed, all that the astronomer values most, is attained; but the exterior workmanship is rough, inelegant, and clumsy. This circumstance probably operates against them. People are so prone to be influenced by external appearances, that philosophers in rags are never made the companions of kings. A little more attention to this part of the business would certainly have a tendency to call the attention of the learned. At present, the tubes and stands are too abominably ugly.—[Scientific Tracts.]

The Book of Science, adapted to the comprehension of Young People.

MECHANICS.

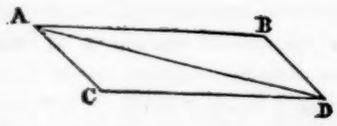
[Continued from page 40.]

In the preceding examples, the object has been to show the effect of opposing forces in producing equilibrium; but precisely the same method may be taken to explain the operation of forces applied in different directions, when their effect is to produce motion instead of restraining it.



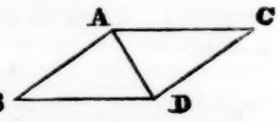
If a body A be impelled at the same time by two forces, which would separately cause it to describe the lines A B and A C of the parallelogram A B D C, the body will, by their joint action, describe in the same time the diagonal A D. For if the body had been previously moving with the velocity, and in the direction A B, and had been acted on at A by the force A C, it would have described A D in the same time. So that, whether the forces begin to act simultaneously or successively, their effects may be calculated on similar principles.

When the angle at which the different forces meet is very acute, they act with greater power on the moving body; thus, as

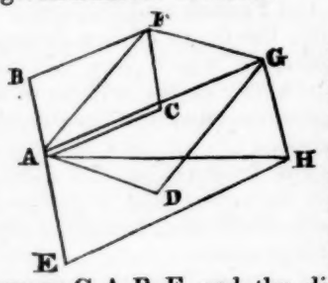


the angle C A B, made by the directions of the composing forces, decreases, the effect arising from their joint impression will be increased; and hence the diagonal A D, which expresses that effect, will likewise be increased. Therefore, when the angle C A B vanishes, or, in other words, when the sides A C and A B coincide with the diagonal, the joint forces will have their full effect; but this would no longer be a case of the composition of forces, but of the junction or union of two forces.

When the angle B A C, made by the directions of the two forces, is very obtuse, their effect is diminished, and the diagonal, representing the resultant of the forces, is consequently contracted. It will be obvious, therefore, that when the sides A B and A C meet without forming any angle, the forces will act in opposite directions; and, provided they were equal forces, they would destroy each other, no motion taking place; but if one force be superior to the other, the body will move on, not in a diagonal line, but in the direction of the greater force.

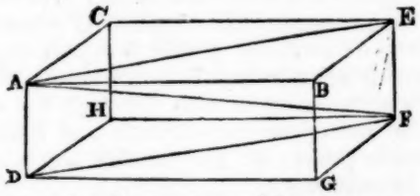


The combined effect of three or more forces acting on a body in different directions may be discovered by means of the parallelogram of forces; and a single force may be thus assigned which will be the resultant of those forces. This may be done by obtaining first the diagonal, representing the resultant of the combination of two forces, and considering that diagonal as the side of a parallelogram, of which a line representing a third force will form one of the other sides, and the parallelogram being completed, the diagonal will be the resultant of the first three forces; and the operation may be extended in the same manner, so as to discover the ultimate resultant of any given number of forces.



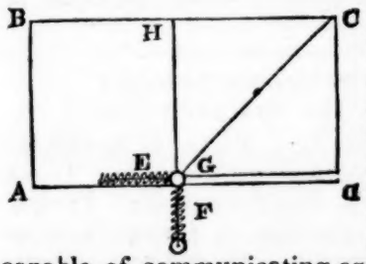
Let the point A be impelled by forces in the directions A B, A C, A D, and A E; then, to find out the resultant of these combined forces, complete the parallelogram C A B F, and the diagonal A F will exhibit the result of the forces, A B and A C. Complete the parallelogram D A F G, and its diagonal A G will denote the result of the three forces A B, A C, and A D. In

the same manner, complete the parallelogram E A G H, and the diagonal A H will represent the force compounded of all the four forces, A B, A C, A D, and A E. But the construction may be simplified by merely drawing the lines B F equal and parallel to A C; F G corresponding with A D; and G H bearing the same relation to A E; then, the line joining A and H, which as before will express the resulting force.



It may be demonstrated by means of the parallelogram of forces, that from three forces acting in the directions A B, A C, and A D, in the proportions of the length, breadth, and depth of a parallelopiped, will result a motion in the diagonal A F of that parallelopiped; for A B and A C compose A E, and A E and A D compose A F; which last is the resultant of the moving forces in the directions of the three sides of the parallelopiped.

The effect of the composition of forces, when a body impelled in different directions takes its course in a diagonal line between the two impelling forces, may be thus experimentally exemplified:



On a billiard-table, A B C D, place a ball at G, equally distant from the side B C, and the end C D, then let two spring guns, capable of communicating equal impulses, be placed so that when the ball is impelled by E, it will move along the side A D, and that when the ball is impelled by F only, it will move in the line G H: then if the ball be struck by both the guns at the same instant, it will be found to move in the diagonal line G C, in the same time in which it would have moved from G to D, impelled by the gun E alone; or from G to H, if acted on only by the gun F. From the observations which have been already made on the relations between the extent of the lines described by moving bodies, and the amount of the forces by which they are impelled, it will be apparent that this experiment may be so modified as to show what would be the direction of the ball, when the impending forces, or the angles at which they acted, were variously adjusted.

The operation of the principle called the composition of forces may be perceived in numerous cases of frequent occurrence. Indeed, there are no motions with which we are acquainted that can be considered, strictly speaking, as instances of simple motion; for the effects of gravitation, and the diurnal motion of the earth, are alone sufficient to occasion some degree of complexity in all motions taking place on the earth's surface. Simple motion, therefore, is only relative.

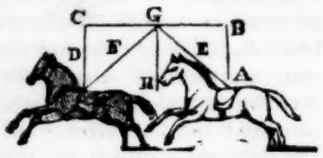
Suppose two persons to be seated on the opposite sides of an omnibus, or any other oblong carriage, and to pass a ball forwards and backwards, from one to the other, in a level line. Now, if the carriage were four feet wide, and the ball were passed across that space in precisely the same time that the carriage would be going four feet along an even road, the real motion of the ball through the air would be in a zigzag line.

A stone dropped on the deck, from the mast-head of a ship under sail, would be affected by the motion of the vessel, as well as by the force of gravitation, and would therefore fall, not in a perpendicular, but in a diagonal line.

Let A represent the mast, C the stone, D the deck, and the line C E will be the distance that the mast-head will have moved, while the stone would have fallen, by the force of gravity alone, from C to the point under it on the deck; the mast, being fixed, is carried forward by the ship, and therefore the foot of the mast will have moved equally with the head, and will have reached the point vertically beneath E, when the stone touches the deck: the stone will also be found at the foot of the mast, having taken a diagonal direction, in consequence of its being impelled at the same time by the ship's motion, and by its own weight. For, if it had not been affected by the former as well as the latter, it would have fallen where the foot of the mast was when it began to fall, and not at the actual foot of the mast.

Any one who has witnessed the common feats of equestrian exhibiters at Astley's amphitheatre, or elsewhere, may have seen a man leap from the back of a horse over a garter or handkerchief stretched horizontally across the track in which the horse was galloping, round the border of a circular area, and the horse passing under the garter, the man comes down again on the saddle, after finishing his leap. To do this, it is only necessary for the rider to spring upright from the saddle, on which he was previously standing, and suffer himself to

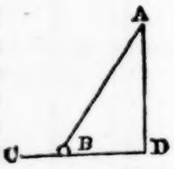
sink by his own weight again on the saddle; for as his body would partake the motion of the horse, that force would be sufficient to



carry him forwards, and his motion in rising, by an impulse which would carry him from A to B if the horse were standing still, would be nearly in the line E, while he would descend in the corresponding line F, through the joint effect of the force derived from the horse and his own weight, the latter of which alone would occasion him to sink in the direction C D, or G H.

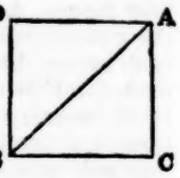
As it has been observed that all motions are really of a compound nature, resulting in a greater or less degree from combined forces, it may sometimes be requisite to ascertain the separate effects of acting forces; or to determine what portion of any given force acts in some direction different from that in which motion takes place. The operation requisite for this purpose is called the resolution of forces, the object not being as before to discover the resultant from the combining forces, but to discover one or both of those forces from the resultant.

If a compound force, acting upon a body, produces motion in the direction A B, and it is required to find the part of that force which affects this body in any other direction, as D C; by drawing A D perpendicular to the direction D C, will be found the proportion which the absolute force bears to that part which, acting alone, would produce motion in the proposed direction.



A boat may be moved across a river by the current passing in a direction parallel to its banks. To effect this the boat must have a rope fastened to it, the other end of which is connected with another rope extended directly across the stream, a noose or ring being fixed to the first or boat-rope, through which the stretched rope is passed in such a manner that the ring may slide freely in either direction. Then the rudder of the boat being properly turned to receive the impulse of the current, it will pass across the river; for the ropes will prevent it from being carried down the stream, while it glides with ease transversely as the ring of the boat-rope slides from one extremity to the other of the extended rope. Part of the force of the current in this case is destroyed, and the remainder is made to produce a motion in a direction different from that in which the water is flowing. The velocity of the current and that of the boat being ascertained, it would be easy to calculate what proportion of the moving force acted on the boat.

The navigator, in crossing the wide ocean, from observing the course of his ship, ascertains the longitude and latitude at different periods of his voyage. Thus, supposing the course



of a ship for a certain time to be towards the south-west, then, if D A and B C represent parallels of latitude, and D B and A C parallels of longitude, the diagonal line A B will describe the ship's path through the sea; and the difference of longitude and latitude, at certain points of the vessel's track, may thus be estimated.

When the impulse of air or water is employed as a moving power, either can seldom act directly and with full force, some portion being lost, and the effect consequently diminished. A ship sailing with a side wind has the sails set obliquely with respect to the course pursued; so the vanes of a windmill, and the float-boards of an undershot water wheel, are moved in general by a force applied in a slanting direction. Indeed, the motion of a windmill would be prevented by setting the surface of the sails perpendicular to the direction of the wind. In these, and many other cases, only part of a moving force is brought into action, the other part being dissipated and lost, because it cannot be made to act in the required direction.

[From the Annals of Education.]

REASON AND THE AFFECTIONS.

Extracted from Mad. Necker de Saussure's work on Progressive Education. Translated by Mrs. Willard and Mrs. Phelps.

[During our visit to Switzerland, we were so happy as to form the acquaintance of Mad. Necker de Saussure, of Geneva, a daughter of the celebrated naturalist and pioneer of the Alps, M. de Saussure, and the widow of the son of Necker, the minister of Louis XVI. Agreeably to a pleasant usage of Geneva, she continues to bear the name of both families. We were deeply interested in her views of education, and brought out to this country a work on early education, for which we have sought in vain for a translator. We are gratified to find, that the task has been performed by Mrs. Willard and Mrs. Phelps; and from the specimen we have seen, we trust the translation will be a valuable addition to the library of education. The annexed extract, on an important topic, deserves serious reflection.]

What are we to understand by the word

reason? In the extended sense which philosophy has given to it, we employ it to express understanding, that great faculty of the soul by which we discover truth. Taken in a more limited sense, it is applied to the conduct of life, and continues to retain its first signification. Reason, also, as it is commonly considered, decides upon the relation of effects to causes, deduces consequences from principles, and pronounces relatively to the individual upon the advantages or inexpediency of actions. Elevated above the inequalities and weaknesses common to humanity, we may consider it as the wise counsellor, who, in the government of ourselves, endeavors to maintain an equilibrium between our different powers. If it finds itself supported by exalted principles, it takes a very elevated character. United to religion, it may become the lofty wisdom which comprehends our internal interests; confined to the moral world, it draws, from the constitution of society, practical rules for our conduct. Indeed, whatever principle we admit, and whatever feeling animates us, this governs, in the calculation of the consequences which we are to experience from them. Incapable of creating our various inclinations, it only teaches us to direct those which exist. It is then a regulator, and not an impulse. This alone shows the kind and limits of its power.

When reason considers man in the abstract, it supposes him endowed with the most noble qualities, and consequently points out to him the greatest happiness to which he can aspire. From this fact arise the admirable precepts which the wisdom of all nations has collected; but when reason addresses herself to the individual, she does not find in him all the faculties equally developed; some are languishing, others have an excessive activity; and as she can only appeal to those which already possess a certain degree of life, there remain to her few general rules to give.

Yet the influence of reason is always salutary; it takes the future into the account; it forms a union among the weak sentiments, in order to subdue the more violent; it says to a creditor irritated by the continued delays of his debtor,—If you cause this man to be imprisoned, you will feel pity at the distress you will occasion his family, and the world will condemn your excessive severity. These considerations may be perfectly just; but why has reason produced an effect in presenting them? It is because it has found compassion and the fear of blame; otherwise it would have had no influence.

Such is the part of reason. Its skill consists in balancing the desires, the one class by another; its resource is the action of opposing forces. Possessing of itself no power, and acting but by the aid of the very feelings which it is sometimes called to oppose, if it finds in the soul nothing which favors its influence, it loses all its efficacy. When this is the case, there is no foundation in the character, either for morality or true happiness.

Education cannot therefore attend too soon to the establishment of impulses; it should direct the development of the various faculties which act upon that sensible part of the soul from which the desires spring, and where decisions are formed. There are impulses of various kinds, which it is useful to distinguish. Some, more particularly named instincts, watch over the preservation of our material existence; others, not less selfish, but more nearly allied to morality, are stationed to guard that part of our happiness which depends upon the opinion of men. Such are self-love and its various modifications. Others, more elevated, as the feelings of justice, truth, and beauty, introduce the soul into the calm regions where it is purified, enlightened, and enlarged. There are others more impetuous, which seem to transport our existence out of itself, to place it among objects foreign to us, and cause us to live in other souls; such are the tender affections, which, from sympathy, their weakest shade, to the complete devotion of love, cause us to experience, for our fellow-creatures, emotions as vivid as those which have self for their object. Finally, there exists one impulse which combines all the others possess that is great, tender, or devoted, which elevates the soul, not only above its proper sphere, but the world itself, and gives it a foretaste of eternity. This, I need not to say, is the religious sentiment.

This inequality in the moral value of the impulses of the human heart prescribes to us the course we should pursue. It is the more essential for education to cultivate the disinterested and generous feelings, as these alone require culture. The selfish desires and physical instincts grow without care; they are even indestructible. If then you do not strengthen those which balance them, you not only cease to make any progress towards good, but you deprive reason of the greatest force which she can oppose to unreasonable desires. Do we not see that the passions are ungovernable in selfish hearts? This is what we do not, perhaps, sufficiently consider.

Thus each state of morality and of feelings corresponds with man to the idea of a certain kind of happiness; and his reason, limited by this state, can indicate to him nothing beyond. Extol to some beings the

beauties of nature, the charms of study, of friendship, of domestic life, and your voice will resound in the desert of his heart. If the effects of eloquence are transient, it is because it has only roused dormant impulses, which very soon sink to their former state; having never been called into action, they are not there connected with the permanent interests of life.

Confined to a sphere, yet reason does her best; what more could we wish? Ask of her to regulate interests purely material, she will counsel to prudence; she will tell you to abuse nothing, to preserve your health, your fortune, and will make of you one of those people whom Socrates ridicules in the Phedore, in saying that they were temperate by intemperance. Seeking to make us avoid dangers, she will encourage the observance of the social laws, since we cannot neglect these without exposing ourselves; and, without having the motive of hope to give us, she will have, at least at her disposal, a liberal supply of threats.

Where reason does not find itself based upon lofty principles, it preaches the morality of consequences; it leads us to view the results of our actions more than their motives, and shows that vice produces evil, instead of leading us to regard it as itself an evil. It thus enters again into the system of utility, the master-piece of its most ingenious combinations, insufficient, like itself, for its own ends, and without value in improving the heart. It undoubtedly possesses a repressive principle, but a force which can only be employed to restrain is often insufficient even for that. It is necessary to have the power of opposing one emotion to another, the sallies of good feelings to those of bad desires; for if the simple barrier of duty only is opposed to them, the violent passions too often overleap it.

That reason is indispensable in life, that without it we could not take one step, that it is necessary to govern the inclinations, or to direct them, I readily admit. I say further, that, in a very extended point of view, we see that it has some power over the formation of sentiments; but it is an influence slow and indirect. In frequently repressing excess, it deprives the bad inclinations of exercise in the same proportion, and may, in time, extinguish them. There is implanted within us a principle of developement, a vitality, which, restrained in one direction, is borne in another; and even the feeling of selfishness cannot, for a long time, remain stationary in the human heart. The character of the same generation changes little; but what one does by calculation, another does by impulse. The religious and disinterested feelings spring up, and facilitate, in their turn, the work of reason. She then causes a prevalence of truths which have long remained dormant, and which assume a rank in society, as soon as public sentiment accords with them; and when these truths are expressed in actions, when they influence manners, and institutions are consecrated to them, their real value appears in the production of national intelligence and virtue.

But it is the correspondent developement of feelings and intelligence which produces these happy results, and these can be but little appreciated at a distance. Ages and people must be placed in the balance, in order to perceive the weight which reason has given to them. When she has not time to act, when her action is confined within the narrow sphere of the mind of a single man, her influence must be very limited; in order to produce great effects upon communities, reason must have a simultaneous action upon many minds.

On all sides we discover our limits; this is what I propose to show. The emotions are impetuous, blind, subject to various excitements; but they are the living forces of the soul. Let us cultivate them in our children, along with the intellectual powers; let us never leave them without nourishment in the heart, or without exercise in the life, and let us not repose upon reason alone. We believe that the greater part of the evils of this age may be attributed to that systematic personality which leaves individuals without energy, as well as the political body without vigor. When one is attached to nothing, it is well for him to be attached to himself. Selfishness is only a more severe word to express indifference to others; its natural effect is to neutralize all other loves.

In general, the fault of education is rather negative than positive; it is in what we neglect, rather than in what we do. During a long course of instruction, where all is passive with the child, without understanding the nature of the mind, there is danger that its fair proportions will be irrecoverably altered. The memory and reasoning powers are too often exercised alone, and the feelings are neglected, excepting self-love, which is excited as a stimulant. What may we expect will be the result of such a course? Exactly what we may observe with grown people, a great want of disinterested motives, and an ever increasing preponderance of those which are sensual or selfish; such cannot fail to be displayed sooner or later. A will, feeble for what is good, ardent and skilful for every other object, thus becomes a necessary consequence.

[For the Apprentice s Companion.]

MR. BURDEN AGAIN.

Among all the classes of people who constitute the human family, there is no other class who are so useful to the whole, and so poorly paid for it—who are so completely the sport of fortune's unfeeling frolics—so often dieted on hope, to increase the bitterness of disappointment—as the inventors of useful improvements. To a person who is capable of duly appreciating the services of those people, it is therefore peculiarly pleasing to meet with one of them who is proof against the game which fortune would otherwise play upon him, who will not submit, like a silkworm, to spin his cocoon for the benefit of posterity, and die in obscurity, or be scalded to death, but who, when sunk into the yawning gulf of disappointment, will rise triumphant upon the next billow, and laugh at the effects of fate to depress him.

Such were my feelings on being shown a number of horse shoes said to be made by the above named gentleman, by the help of a machine which he had invented. The shoes were very perfect, and I was told his machine would produce forty a minute. I had watched that gentleman's operations with no small interest as an unobserved spectator, while he was rapidly acquiring property by his machinery for making spikes. When, by means of his own mental and bodily exertions, and with his own money, he engaged in his plan of a steamboat, I had strong hopes of his success, but they were not unmixed with fears. But when those fears were nearly dispelled by his prospect of success, when fortune appeared to have acknowledged his demand, and to be actually loosening her purse-strings to reward him,—at that exquisite moment, when his hopes were changing to exultation, but when at one rude crash his labors and his hopes were sunk together, and no visible object intervened to save him from despair and oblivion, I can truly say, that my feelings were more excited than they had ever been by any circumstance in which I had no interest, not even then of a friendly personal acquaintance.

No person will wonder then that when I saw the horse shoes, and learnt their history, I felt a strong desire to see their birthplace, and examine for myself not only the truth of what had been told me, but the *modus operandi* by which the effect was produced.

Accordingly I visited the place a few days since, and though I presented no credentials, I found no want of kind civility, and the result paid me most amply for time and travel. The machine was not yet completed, and consequently not in operation. The shoe in the process goes through three distinct operations, but following in as quick succession as the eye can trace. The first operation requires about twice the time of the others, and is of course to have a duplicate of that part of the apparatus to make it keep pace with the other two parts, and lose no time. It is at present merely set up for trial, and attached to the power of the water-wheel which drives his spike machinery, and which has no power to spare. A wheel to propel the horse shoe apparatus will be completed in a few days, and in four weeks the establishment will be in full operation. A bar of iron was heated and put in to show me the operation, which whole bar was converted into horse shoes in a little more than one second each. The last shoe came out apparently as hot as the bar went in, and when the part which is to double the first operation is completed, it will make at least 80 shoes per minute. And yet every part of the machine appears to be almost as simple, and quite as little liable to disorder, as a common grindstone; and what appears quite remarkable, it is only a different modification of the machine he has long had in use in making spikes.

If we allow one man to every eight persons in the United States, and one half of these to have a horse apiece, there would be 875,000 horses, which is probably far within the truth. To shoe these horses all round, twice a year, would require 7,000,000 shoes. Allowing his machine to make 80 shoes a minute, and to work ten hours in a day, and 300 days a year, one machine would make 14,400,000 shoes in a year. A small sized shop would be sufficient to contain the machine and necessary workmen, and a small water power would propel it; so that one machine would make the shoes for the above number of horses, and have half the time to make repairs.

The shoes I have examined weigh 1¼ lbs. each, and 7,000,000 shoes would weigh 3906¼ tons, so that he would have to send from his shop on an average rising of 13 tons daily, which shoes, at one cent per pound profit, would amount to 87,500 dollars a year. There are very few horses which are not shod more than twice a year; and no man can live by making horse shoes, and finding his shop, tools, and coal, at *two* cents a pound. I see nothing to hinder Mr. B. from realizing the amount here calculated, and I should rejoice to see it doubled.

He has still some prospects with respect to his boat, and he is engaged in a series of experiments to decide the point which has so long and so completely baffled all calculation—the quantity of *friction* produced by smooth surfaces passing through water; and the plan he adopts to effect it is, I should

say, infinitely more demonstrative than any other I have seen.

He who would not wish success to such a man, I would not chose for a neighbor.

ARCHIMEDES.

[For the Apprentices Companion.]

CRUELTY TO ANIMALS.

To any person who has cultivated and cherished those sympathies, the seeds of which the creator has for wise purposes implanted in our nature, there is no other conduct in human life so completely shocking, and so painful to the beholder, as *cruelty*, in any shape; but especially to animals not invested by nature with the power of speech, and therefore incapable of pleading their cause or telling their grief. Every thing that has animal life, whether great or small,—from the whale or the mammoth, down to the animalculæ, visible only by the aid of the microscope—is invested with sensation and perception, and has the same love of pleasure, and hatred of pain, and doubtless the same dread of death, as the proudest monarch, or the greatest philosopher; and all have received them from the same source.

"The poor beetle that we tread upon,
In corporeal sufferance, feels as great a pang
As when a giant dies!"

It is true that many animals appear formed by nature to prey upon each other for their own subsistence; and man perhaps may have the same right to prey upon the whole; but this gives no right to inflict pain, and especially to take life, any further than our own subsistence or our own safety requires.

But sympathy, though, when cultivated, the source of infinite pleasure, yet, when not so, remains forever inactive, like a diamond in the mine, of no more use than any other earth.

But this is not all. We are so much the creatures of education, that where the cultivation of sympathy has not been general, but lopped and twisted like fruit trees in a garden, to suit the fancy of the cultivator, though extremely sensitive in some cases, it is utterly destitute of feeling in others. There can be no question but the ladies in Spain, who can be the delighted spectators, at a bull-baiting, to see the noblest animals that can be found, torturing and mangling each other to death, and even men sharing the same fate, have as great a share of the seeds of tenderness in their natures as any other females on earth; but education has never awakened their reflections to consider that the poor animals, or even the men, who suffer torture and death for their sport, have any feelings.

But we need not go to Spain to see the cultivation of sympathy neglected. When I see boys allowed to ramble the fields for the purpose of robbing the poor innocent birds of their nests, and their young, and all that is dear to them, or gathering round ponds and streams to pelt the frogs with stones, I cannot but consider, that whatever may be the pretensions of their parents to refinement and respectability, their education has been shamefully neglected. The child who is suffered to delight in torturing a fly to death, needs only the same neglect of education to insure him the same delight in manhood, in torturing a man, if the law did not restrain him.

I cannot help believing, that if a little more attention should be paid to this important part of education; if our youth of both sexes were taught, as soon as they begin to be capable of reasoning, that it is worse than brutish to inflict, not only pain, but torture and death for our amusement, if they were taught to feel and appreciate the power of sympathy in sharing the pleasure of every creature we see happy, there would in a short time be no such thing as cruelty. If this were duly attended to, we should not long see our young men prowling about the fields to shoot harmless birds, merely for the pleasure of shooting them; we should not see our farmers, as is now the case in some places, while driving their patient oxen, laboring as if they were threshing, while the hateful sound of the lash is heard farther than even the rumbling of their wheels; and our ears would not be pained with the screaming of swine, while *their* ears are torn from their heads by dogs, kept for no other purpose but to torment them.

S. BLYDENBURGH.

KNOWLEDGE FOR THE PEOPLE, OR THE PLAIN WHY AND BECAUSE.

(Continued from page 48.)

Why do persons, walking arm-in-arm, shake each other unless their steps correspond?

Because the centre of gravity in each body comes alternately over the right and over the left foot.

Why are certain metals malleable, or reducible into thin plates or leaves by hammering?

Because their atoms cohere equally in whatever relative situation they happen to be, and therefore yield to force, and shift about among each other, almost like the atoms of a fluid, without fracture or change of property.

Gold is remarkably malleable, for it may be reduced to leaves of the thinness of 282,000 to the inch. For gold-beaters the metal is first formed into rods, these are afterwards rolled or flattened into ribands,

the riband is cut into portions, which are extended by hammering to great breadth and thinness, and which being again divided into portions, are hammered and extended to the thinness described.

Why are the steel chisels and tools used for cutting metals so frequently broken?

Because, requiring to be exceedingly hard, they proportionally lose, in regard to the extent of their elasticity. Cast iron, which is much harder than malleable or wrought iron, is very brittle, while soft iron and steel are the toughest things in nature. —[Arnott.]

Why does a smith, by hammering a piece of bar-iron, render it red hot?

Because he thereby compresses the metal. When air is violently compressed, it becomes so hot as to ignite cotton and other substances. An ingenious instrument for producing light for domestic uses has been constructed, consisting of a small cylinder, in which a solid piston moves air-tight: a little tinder, or dry sponge, is attached to the bottom of the piston, which is then violently forced into the cylinder: the air between the bottom of the cylinder and the piston becomes intensely compressed, and evolves so much heat as to light the tinder.—[Lardner.]

Why is the iron rim of a coach wheel heated before putting on?

Because the expansion of the metal occasioned by the heat facilitates the operation of putting on the iron, while the contraction, which follows, brings the joints of the wooden part together; and thus, binding the whole, gives great strength to the wheel.

Why does a bottle of fresh water, corked and let down 30 or 40 feet into the sea, often come up again with the water saltish, although the cork be still in its place?

Because the cork, when far down, is so squeezed as to allow the water to pass in or out by its sides, but on rising, it resumes its former size.

Why do bubbles rise on a cup of tea when a lump of sugar is dropped into it?

Because the sugar is porous, and the air which filled its pores then escapes to the surface of the tea, and the liquid takes its place.

Why are stalactites formed in the interior of caverns?

Because water percolates through their porous sides and roofs, and being impregnated with calcareous and other earths, assumes pendant forms.

Why is there an opening in the centre of the upper stone of a corn mill?

Because through this opening the grain is admitted and kept turning round between the stones, and is always tending and travelling outwards, until it escapes as flour from the circumference.

Why does a horse in the circus lean to the centre?

Because, when the horse moves round with the performer standing on the saddle, both the horse and rider incline continually towards the centre of the ring, and the inclination increases with the velocity of the motion: by this inclination their weights counteract the effect of the centrifugal force.

Why does water remain in a vessel which is placed in a sling and made to describe a circle?

Because the water, by its inertia of straightness, or centrifugal (or centre-flying) force, tends more away from the centre of motion towards the bottom of the vessel, than towards the earth by gravity.

Why does a spinning top stand?

Because, while the top is perfectly upright, its point, being directly under its centre, supports it steadily, and, although turning so rapidly, has no tendency to move from the place; but if the top incline at all, the side of the peg, instead of the very point, comes in contact with the floor, and the peg then becomes a little wheel or roller, advancing quickly, and, with its touching edge, describing a curve somewhat as a skaiter does, until it becomes directly under the body of the top as before. It thus appears that the very fact of the top inclining causes the point to shift its place, and so that it cannot rest until it come again directly under the centre of the top.—[Arnott.]

Why is a rocking-stone so called?

Because it consists of an immense mass, loosened in some convulsion of nature, and with a slightly rounded base resting on a flat surface of rock below, which is so nearly balanced, that one individual can move or *rock* it. This arises from the rounded body being disturbed from its middle position, and its centre of gravity seeking to return.

Of these rocks, called Loggan or Laggan stones, there are several among the picturesque barriers of the British coast.

Dr. S. Hibbert has very recently described a natural rocking-stone of granite, near the village of Loubeyrat, in the province of Auvergne, France. This stone appears to have been an object of religious worship, for on the top of it were two figures, a cross and a pedestal. Under the figures the word *pardon* is traceable, and other letters, which probably alluded to the number of days of pardon which the cross gave to the venerator. The natural phenomenon of the rocking-stone probably became an object of superstitious veneration

to its neighborhood, and the figures and cross were the adoring tributes of the natives. Dr. Hibbert, however, thinks that the particular use to which rocking-stones were applied will ever remain in obscurity: "as they are products of every country where loose detached rocks of a particular structure have been submitted to the operation of atmospheric agents, it is to be expected that the fables assigned to their origin would be regulated by the peculiar mythology of the people among whom they have become the object of notice and wonder."

Why have all shot manufactories lofty towers, as seen on the southern bank of the Thames?

Because, in the manufacturing of shot, the liquid metal is allowed to fall like rain from a great elevation, as through these towers, and the cohesive principle gives rotundity to grains of shot. In its descent, the drops become truly globular, and before they reach the end of their fall they are hardened by cooling, so that they retain their shape.

Why does a porter lean forward when carrying a load?

Because his position must be regulated by the centre of gravity of his body and the load taken together. If he bore the load on his back, the line of direction would pass beyond his heels, and he would fall backwards. To bring the centre of gravity over his feet he accordingly leans forward. If a nurse carry a child in her arms, she leans back for a like reason.

Why does a young quadruped walk much sooner than a child?

Because a body is tottering in proportion to its great altitude and narrow base. Now, the child has this latter, and learns to walk but slowly, because of the difficulty, perhaps in ten or twelve months, while the young of quadrupeds, having a broad supporting base, are able to stand, and even to move about, almost immediately: but it is the noble prerogative of man to be able to support his towering figure with great firmness on a very narrow base, and under constant change of attitude.—[Arnott.]

Why are the "safety coaches" built with the wheels far apart, and the luggage-receptacles beneath the body?

Because they may have a broader base, and thus be less liable to overturn.

Why do builders use the plummet, or plumb line?

Because, when applied to a body, it is a visible indication of the line of its centre of gravity.

Why do certain structures remain secure, although they have lost their perpendicularity?

Because the line of their centre of gravity remains within the base. The famous tower of Pisa was built intentionally inclining, to frighten and surprise; it is 130 feet high, and overhangs its base 16 feet. At Bologna are two celebrated leaning towers, one of which, the Asinelli, is 350 feet high, and 3½ feet out of the perpendicular. The other, the Garisenda, is about 130 feet in height, and inclines 8 feet from the perpendicular. Montfaucon, the celebrated antiquary, attributes the leaning of these towers to the sinking of the earth. He says, it appears, upon examination, that when the Garisenda tower bowed, a great part of it went to ruin, because the ground that the inclined side stood on was not so firm as the other, which may be said of all other towers that lean so; for "besides these two here mentioned, the tower for the bells of St. Mary Zobenica, at Venice, leans considerably to one side. So also at Ravenna, I took notice of another stooping tower, occasioned by the ground on that side giving way a little. In the way from Ferrara to Venice, where the soil is marshy, we see a structure of great antiquity leaning to one side. When the whole structure of the Garisenda stooped, much of it fell, as appears by the top."

The Monument, near London Bridge, inclines so much that timid people sometimes doubt its stability, and some years since its fall was a point of discussion. Salisbury and other of our cathedral spires or towers have lost something of their perpendicularity; Chesterfield, in Derbyshire, is proverbial for its zig-zag or wry spire.

The Monument is of the Doric order, and rises from the pavement to the height of 202 feet, containing within its shaft a spiral stair of black marble of 345 steps; the plinth is 21 feet square. It was begun in 1671, but was not completed till 1677: stone being scarce, and the restoration of London and its cathedral swallowing up the produce of the quarries. Mr. Elmes, in his Life of Sir Christopher Wren, the architect, tells us that the Monument was "at first used by the members of the Royal Society for astronomical experiments, but was abandoned on account of its *vibrations* being too great for the nicety required in their observations. This occasioned a report that it was unsafe; but its scientific construction may bid defiance to the attacks of all but earthquakes for centuries." The more recent fear of its instability was therefore only a revival of this alarm; which probably obtained some credence among weak persons, from its being erroneously attributed to Fellows of the Royal Society.

Why is it physically advantageous to turn out the toes?

Because the supporting base of a man consists of the feet and the space between them; and turning out the toes, without taking much from the length of the base, adds a good deal to the breadth.—[Arnott.]

Why do very fat people usually throw back their head and shoulders?

Because, by so doing, they keep the centre of gravity of the body over the base.

We ask, for the following essay, an attentive perusal by all the readers of the Companion. It is from the American Annals of Education.

NATURAL SCIENCE IN COMMON SCHOOLS.

Essay on the Introduction of the Natural Sciences into Common Schools. Read at the Meeting of the American Lyceum, in May, 1833. By Professor Dewey, of Pittsfield.

As the subject of the following Essay was expressed in general terms by the Executive Committee of the Lyceum, the writer felt himself authorized to discourse upon it in the various aspects in which it presented itself to his mind. He may have entered more fully into the examination of the subject than the Committee expected; and he may have failed to treat upon some part of the subject which they had contemplated. As it is, the essay is presented before them. The thoughts will be arranged under several distinct heads.

I. Object and General View of the Natural Sciences.

The design of Natural History is the description of all the natural productions to which man has access. Its subjects are as numerous and diversified as are the objects in the atmosphere, in the waters, and on and within the earth itself. The science carries the student into an examination of this extensive department of the works of the Divine Being.

A general and particular classification of natural objects is indispensable to the description of them. The first great and general division is into the three kingdoms, *mineral*, *vegetable*, and *animal*, which comprehend all the objects belonging to our globe.

The Natural History of the *mineral* kingdom comprehends the great subject of *Mineralogy* and *Geology*. Mineralogy classifies and describes all the earths, clays, ores, coals, stones, salts, gases, acids, waters, &c., which are natural productions, and which possess one homogeneous nature, or exhibit homogeneous properties. Geology performs the same task with the rocks or masses compounded of the preceding minerals, lying in extensive strata over the globe, and the strata of earth and clay, and examines the general structure and formation of the crust of the earth, and those changes which have taken place in the materials of which the earth is composed.

For the complete description of these objects, the science of *Chemistry* is essential; for no description will approximate completeness, which does not include the knowledge of the *elementary* substances and their properties, of their combinations and actions, and of the qualities of the compounds. Chemistry, extensive as it is in all its applications, is, in truth, only a subordinate part of the science of Natural History.

Geography, also, so far as it is a description of natural objects and exhibits the character of the surface of the earth, its rocks, mountains, volcanoes, petrifactions, waters, earths, soils, productions, native or cultivated, is entirely subservient to the great object of Natural History.

Thus far the naturalist contemplates only matter destitute of organization, and operated upon by those unknown and yet well known powers, gravitation, cohesion, and magnetic or electric or chemical agencies. In the other two kingdoms, *organized* objects are described, exhibiting that well known principle, that mysterious influence, that mode of divine operation, which we familiarly call life.

The *vegetable* kingdom comprehends every plant, as herb, tree, grass, ferns, seaweed, &c., as well as the lichens and fungi, those often minute and shapeless objects, fastened to rocks and trees, or buried in the earth, or just projecting their heads above its surface. Plants cover the earth and rocks, and throng the waters, from the equator to the highest latitude yet attained by suffering industry. To him, who has thought of the vegetable world, chiefly in the 'cedar of Lebanon,' or the lofty pine or oak of the forests, or in the general dress of green that decks the country, or in the blushing carnations that adorn our gardens and pastures, or waste their beauty and fragrance on 'the desert air,' the vegetable kingdom is yet an unknown world; and he is a stranger to the delight with which the *naturalist* searches out the history of a plant too insignificant perhaps to arrest *common* attention for an instant. All this world of vegetable life and wonder it is the province of the *botanist* to explore, and to pour into the treasures of Natural History the descriptions of the riches he has procured from these varied and wonderful works of the great Creator.

Botany describes and arranges the whole

kingdom of plants. The method, whether on what is technically called the *artificial*, or the *natural* system, is admirable. A great general division of plants is first made, comprising, in one body, those whose organs, employed in the production of fruit or seed, are *visible*, and in the other body, those whose like organs are wholly invisible, or seen only by high magnifying power. The *latter* division of plants, of which there is a vast multitude, but which present few attractions to most minds, may be passed with only this general consideration; while the *former* division, which contains the common, and most useful, and ornamental plants, is open to the examination of any mind. The division of plants into *Classes*, *Orders*, *Genera*, and *Species*, or into *Natural Families* and *Orders*, renders the prosecution of any part of Botany a matter of comparative ease. Connected, as this may be, with the *facts* of their *economical* use, as food for man or beast, as employed in the great variety of arts and manufactures, as medicine, or as mere ornament, and thus supporting rational life, or promoting the convenience and restoring the health of man, or of multiplying the sources of rational enjoyment, and of developing more perfectly the powers and beauty of the human frame, even a partial knowledge of the vegetable kingdom must be deeply interesting to all who can acquire it.

The *animal kingdom* is the last and highest of the three grand divisions of natural objects. The organization is more complex and wonderful, and the life itself of higher character. Although it has not been thought easy, in every instance, to point out the difference between a vegetable and an animal, it will be sufficient to consider *voluntary motion* as the characteristic of the animal kingdom. Even in the lowest grade of shell-fish, confined to a rock, we see indications of the same *voluntary* power.

Zoology is the arrangement and description of animals. The divisions are very logical, and the system very complete. If we consider it only in relation to beasts, birds, fishes, &c., a selection of objects of knowledge is very easy.

To excite our attention, however, to the multitude of objects in the animal kingdom, I shall merely mention some of the divisions in zoology: *Crustaceology*, the science of shell-fish, as crabs, lobsters, centipedes; *Conchology*, of shells, as the clam, oyster, snail, &c.; *Entomology*, of insects properly so called, bugs, flies, bees, &c.; *Herpetology*, of oviparous quadrupeds, crocodiles, turtles, lizards, frogs, &c.; *Ophiology*, of snakes and serpents; *Ichthyology*, of fishes; *Cetology*, of whales, dolphins, &c., which produce their young alive, and support them by milk; *Ornithology*, of birds; *Mazology*, of quadrupeds producing living young and suckling them.

II. Reasons for the preceding general view.

I have considered the objects of Natural History thus particularly for several reasons.

1. That the magnitude of the subject, in all its parts, may come up before us, and convince us that only a small part of it can be introduced into common schools.

2. That our attention may be directed to those portions of it which are the most accessible, and have most facilities already prepared.

3. To show the Lyceum that it is not without some plausibility, that many a zealous cultivator of some branch of Natural History considers the project of introducing this study into common schools as little less than a satire upon wisdom, and a burlesque upon knowledge. The finest minds have employed the leisure hours of their lives, and others of most splendid talents have consumed all their days upon the study of only a small part of Natural History, and before them rises, not the mere image, but the living reality of the schoolboy, who will not be able to learn more than the rudiments of common education, engaged in this vast study. The prospect is sickening to their souls.

I hope, however, to show that the magnitude and difficulty in attaining a knowledge of it is not opposed to the accomplishment of all that is intended in the common schools. The full and scientific study of the subject would be absurd.

4. That he is a public benefactor, who leads the minds of youth to any interesting knowledge of any of the multiplied works of the Creator, or surrounds them with facilities for becoming better acquainted with these works. The honor now resting upon many who have labored in this cause, will continue to reward those who shall labor for the same great object.

III. Selection of Subjects in Natural Science.

Those parts of Natural History generally considered most appropriate to common schools are Mineralogy and Geology, Botany, and some portion of Zoology. Only parts of these can be made use of.

In *Mineralogy*, the names and general properties of the minerals about a town or district, so as to be readily recognized, might be easily acquired; and in Geology, the knowledge of the rocks and strata of rocks or earth, wherever any were visible:

also, the general uses of these substances in the arts. This has already been proved by experiment in several schools in Massachusetts; and minerals have been sent to other schools, by way of exchange.

In *Chemistry*, a large number of experiments of the simpler kind might be performed by means of simple and common articles. A little expense would enable a teacher to exhibit some of the gases, and some of the more striking experiments. I have known boys of ten years of age, in my school, form the illuminating gas by a means of a tobacco pipe and some oily seed, as that of the butternut or sunflower, cemented in the bowl by clay, and have seen them delighted with the bright flame produced by its combustion at the end of the stem.

In *Botany*, the parts of plants employed in the descriptions, as the several parts of the flowers and leaves, and the arrangement of plants, as well as the names of many genera and species, might be learned. I knew a lad of eleven years, who, by collecting plants with a botanist two summers, learned the names of four hundred species, and was able to distinguish many more, whose names were not familiar to him, as well as to analyze flowers to a considerable extent.

In *Zoology*, some of the parts of Entomology would be most easy, as insects are so abundant, and many of their changes are so easily detected; of Herpetology, in relation to tortoises, lizards, &c.; of Conchology, in respect to land and fresh water shells in the country, and collection of shells along the shores of the ocean. Of birds and quadrupeds, the means of knowledge are increasing continually. The collection of specimens would be a healthy exercise, and exert a favorable influence over body and mind, while curiosity would be exerted and gratified.

IV. Advantages of Natural Science in Education.

Besides the value of the knowledge itself, there are indirect advantages attending the study of Natural History, some of which I shall briefly state.

1. This study calls into efficient action the power of discrimination. The constant tendency of the mind is to consider things in the mass. Particularity requires attention, care, direct effort of the mind. Not a step can be taken in Natural History without discrimination. We must *begin* with particulars, and we must *go on* with *particulars*. And we must often begin with a very small part of one particular thing. The mind is trained to minuteness of examination, and to the improvement of its power of seeing and making distinctions. Thence the mind proceeds to generalization. The *inductive* philosophy is the glory of modern times. It begins with particulars, and ascends to general conclusions.

2. The relation of one part to another of an object must be observed. The process of examination is fitted to induce the habit of attending to the relations of things, and of creating the power to consider the relations of things in all cases.

3. It leads to the adoption of system, arrangement, method, classification. Consider the multitude of facts in Chemistry, insulated and independent, until they were reduced to systematic order by some of the master spirits of modern times. In Botany, the wonderful genius of Linne brought into order the heterogeneous mass of its materials. This system, order, arrangement, is now a part of the subject itself, and the study cannot be prosecuted without this part of logic being practically enforced upon the mind.

4. It awakens curiosity and opens the eyes to look with interest upon the works of God. It rouses the faculties from that listlessness, to which there is so strong a tendency in the naturally *indolent* state of mankind, and yields to the mind that gratification so desirable to be obtained from the very exercise of the powers.

5. It stores the mind with objects of thought and interest, and prepares it to increase their number. These objects, too, can attend us in all our excursions. The naturalist is ever surrounded with those objects which have roused a deep interest in his mind. Cicero's splendid panegyric on Literature is equally applicable to Natural History.

6. Though many of the subjects have less apparent contrivance, and design, and adaptation, than some others, yet these become more evident, as the knowledge is increased, and are finally seen on every side. The mind becomes more familiar with the works of the great Architect, and perceives more of the benevolence and wisdom of our heavenly Parent, if the study is conducted in the proper manner.

Hence these studies exert a peculiar influence on the character of the young. The curiosity excited, and the objects presented continually on every side, offering employment for the mind, and exercise for the body, might naturally lead to important intellectual and moral results. I am aware that this advantage is not the most obvious, and I shall only confirm its truth by a mere allusion to several instances of young men, who have, by an attention to Natural Science, been arrested in their mad career to intellectual and moral ruin. Some of

these cases are known also to some members of the Lyceum.

Some part of these *indirect* advantages must attend any considerable attention to this study, and be enjoyed in no small degree by the young.

[For the Apprentices Companion.]

SIR,—The following "short sermon," well understood and practised upon, will make the fortune of any boy who lives to be a man of middle age. "*Let your economy be of to-day, not of to-morrow,*" is a very important rule. Many a young man has remained poor all his life, for no other reason than that he omitted to practise upon this rule.

A SHORT SERMON.

How to make Money.—Do you complain that you have nothing to begin with? "Tom," you say, "has a farm, and Harry has 1000 dollars, but I have nothing." I say to you, look at your hands, and tell me what they are worth. Would you take one thousand dollars for them, or for the *use* of them throughout your life? If you can make half a dollar a day with them, it would not be a bad bargain, for that sum is the interest of more than two thousand dollars; so that if you are industrious and Harry is lazy, you are more than twice as rich, and are fairly worth four thousand dollars. Money and land, therefore, is not the only capital with which a young man can begin the world. If he has good health, and is industrious, even the poorest boy in our country has something to trade upon; and if he be besides well educated, and have skill in any kind of work, and, add to this, moral habits and religious principles, so that his employers may trust him and place confidence in him, he may then be said to set out in life with a handsome capital, and certainly has as good a chance of becoming independent and respectable, and perhaps *rich*, as any man in the country. "Every man is the maker of his own fortune." All depends upon setting out upon the right principles, and they are these:

1. BE INDUSTRIOUS—
Time and skill are your capital.

2. BE SAVING—
Whatever it be, live within your income.

3. BE PRUDENT—
Buy not what you can do without.

4. BE RESOLUTE—
Let your economy be always of to-day, not to-morrow.

5. BE CONTENTED AND THANKFUL—
A cheerful spirit makes labor light, and sleep sweet, and all around *happy*, all which is much better than being *only rich*.

ELASTIC MARBLE.—From the quarries in Berkshire county, Mass., are obtained specimens of elastic white marble, of a beautiful texture, and susceptible of a high polish. If there are other localities, thay have not been very distinctly recorded. Supported at the two extremities, the slabs spring like a board placed in a similar position, though the bending is much less. Mineralogical cabinets should all be furnished with samples of this singular stone. — [Scientific Tracts.]

Though men dispute for the purpose of ascertaining truth, there are few who find less of it than those who dispute most.

POSTAGE.—"I only subscribed to patronise the work, I did not expect to pay for it," has more than once been the reply to the collector for a newspaper or periodical. To *this* sort of patronage a publisher may, if he be possessed of a good share of philosophy, submit, and even consider himself pretty well used; but when, as in the following instance, he is charged postage at the outset, to the amount of *half a year's* subscription, upon a work which is put at a price that will scarcely pay its printing, he must be a happy man indeed who can refrain from giving the young gentleman a short lesson of advice, in addition to the *twenty-five cents'* postage he has made him pay. And as the object of this work is to benefit young men, and to give them advice, the present opportunity shall not be lost, and therefore we give the letter entire, omitting the name, as the writer, to whom we shall send this number, cannot mistake himself; and he will not, we think, omit, when he writes for another periodical, especially if the price is only fifty cents, to *pay his postage.*

Mr. D. K. Minor:

Sir,—You may consider me a subscriber to the Apprentice's Companion for two years, and after the first year is out I will enclose you the money.

Yours, J. C. R.

Fayetteville, Tenn., May 13, 1835.

N. B.—If you have commenced the work send me all of the numbers. J. C. R.